BOSTON PUBLIC LIBRARY
3 9999 06543 423 3

FHWA-MA-EIS-82-02-F

Final Environmental Impact Statement and Final Section 4(f) Evaluation

GOVDOC
BRA
5119
Vol. 6 of 6

Third Harbor Tunnel, Interstate 90/ Central Artery, Interstate 93

Boston, Massachusetts

Appendices

Federal Highway Administration
Massachusetts Department of Public Works
August, 1985

FHWA-MA-EIS-82-02-F

Final Environmental Impact Statement and Final Section 4(f) Evaluation

GOVDOC
BRA
5119
Vol. 6 of 6

Third Harbor Tunnel, Interstate 90/ Central Artery, Interstate 93

Boston, Massachusetts

Appendices

Federal Highway Administration
Massachusetts Department of Public Works

August, 1985

GOVDOC

Vol. 6

BOSTON PUBLIC LIBRARY
GOVERNMENT DOCUMENTS DEPARTMENT

FEB 8 1989

FOREWORD

Two-Lane Tunnel/Optional Fort Point Channel Concepts is one of five separately bound reports which constitute the Final Environmental Impact Statement/Environmental Impact Report package for the Third Harbor Tunnel/Central Artery Project, as listed below.

1. Final Environmental Impact Statement/Report (Two Volumes)

2. Public Hearing: Synopsis of Testimony, Responses to Verbal Comments, Transcript

3. Supportive Engineering Report

4. Appendices

5. Two-Lane Tunnel/Optional Fort Point Channel Concepts

The Two-Lane Tunnel/Optional Fort Point Channel Concepts report is organized as follows:

Part 1: Two-Lane Tunnel Concept

Part 2: Optional Fort Point Channel Concepts

Appendices:

Appendix 1 - Air Quality

Appendix 2 - Noise and Vibration

PROPERTY OF B/PB

Digitized by the Internet Archive
in 2012 with funding from
Boston Public Library

http://www.archive.org/details/thirdharbortunne06mass

PART 1:
TWO-LANE TUNNEL CONCEPT

TABLE OF CONTENTS

		Page
1.0	Purpose for Evaluation	1
	1.1 Introduction	1
	1.2 Summary	1
2.0	Engineering Description	3
	2.1 Alignment	3
	2.2 Property and Utilities	4
	2.2.1 Summary of Properties Affected	4
	2.2.2 Utilities	4
	2.3 Construction Staging	9
	2.4 Geology and Soils	12
	2.5 Ventilation	12
	2.6 Power	12
	2.7 Costs	16
	2.8 Sunken Tube Tunnel Construction	16
	2.9 Energy	16
	2.9.1 Summary	16
	2.9.2 Conclusion	16
	2.9.3 Additional Analysis	22
	2.10 Design Criteria	23
	Figures 1 thru 23	25-47
3.0	Environmental Consequences	49
	3.1 Transportation	49
	3.1.1 Summary	49
	3.1.2 Traffic Volumes	53
	3.1.3 V/C Ratios and Levels of Service	66

		Page
3.1.4	Central Artery Bottlenecks and Congestion Points	75
3.1.5	Vehicle Miles, Vehicle Hours and Person Hours Travelled	81
3.1.6	Safety	82
3.1.7	Other Transportation Facilities	86
3.1.8	Construction Impacts	87
3.2	Relocation Impacts	94
3.2.1	Business/Government Agency Takings	94
3.2.2	Displaced Businesses and the Availability of Comparable Relocation Space	94
3.2.3	Related Business Economic Impacts	100
3.2.4	Community Economic Impacts	100
3.2.5	Massachusetts Department of Public Works Relocation Procedures	101
3.2.6	Other Possible Sources of Assistance	102
3.3	Land Use Impacts	103
3.3.1	Regionwide	103
3.3.2	Local Districts	104
3.3.3	Joint Development	117
3.4	Neighborhood and Community Facilities Impacts	118
3.4.1	No-Build Alternative	118
3.4.2	Two-Lane Tunnel Concept	118
3.5	Economic Impacts	122
3.5.1	Impacts on the Regional Economy	122
3.5.2	Impacts on the Project Area Economy	124
3.5.3	Impacts on Subarea Economies	125
3.5.4	Development and Related Fiscal Impacts	127
3.5.5	Measures to Minimize Adverse Effects	129

		Page
3.6	Air Quality	131
	3.6.1 Mesoscale Analysis	131
	3.6.2 Microscale Analyses	133
	3.6.3 Effects of Toll Plazas	136
	3.6.4 Tunnel Ventilation	138
	3.6.5 Effects of Ventilation Building Emissions	140
	3.6.6 Construction Impacts	149
3.7	Noise and Vibration	154
	3.7.1 Noise	154
	3.7.2 Vibration	163
3.8	Water Resources; Wetlands; Floodplains; Vegetation and Wildlife; Dredged and Excavated Material Disposal	167
3.9	Historical and Archaeological Impacts	168
	3.9.1 Impacts on Historic Resources	168
	3.9.2 Archaeological Effects	176
3.10	Aesthetic Impacts	178
3.11	Section 4(f) Evaluation	187
	3.11.1 Parklands	187
	3.11.2 Historic Resources	194
	3.11.3 Archaeological Sites	200
	3.11.4 Consultation	201

LIST OF FIGURES

Figure No.	Description	Page
1	Two-Lane Tunnel Concept, South Bay Area (Plan)	25
2	Two-Lane Tunnel Concept, South Bay Area (Profile)	26
3	Two-Lane Tunnel Concept, South Bay Area (Profile)	27
4	Two-Lane Tunnel Concept, Central Area (Plan)	28
5	Two-Lane Tunnel Concept, Central Area (Profile)	29
6	Two-Lane Tunnel Concept, North Area (Plan)	30
7	Two-Lane Tunnel Concept, North Area (Profile)	31
8	Two-Lane Tunnel Concept, North Area (Profile)	32
9	Two-Lane Tunnel Concept, South Boston Area (Plan)	33
10	Two-Lane Tunnel Concept, South Boston Area (Profile)	34
11	Two-Lane Tunnel Concept, South Boston Area (Profile)	35
12	Two-Lane Tunnel Concept, East Boston Area (Plan)	36
13	Two-Lane Tunnel Concept, East Boston Area (Profile)	37
14	Two-Lane Tunnel Concept - Typical Sections, East Boston Area	38
15	Two-Lane Tunnel Concept - Property and Utilities Plan South Bay Area	39
16	Two-Lane Tunnel Concept - Property and Utilities Plan Central Area	40
17	Two-Lane Tunnel Concept - Property and Utilities Plan North Area	41
18	Two-Lane Tunnel Concept - Property and Utilities Plan South Boston Area	42
19	Two-Lane Tunnel Concept - Property and Utilities Plan East Boston Area	43
20	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #1)	44
21	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #2)	45
22	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #3)	46
23	Ventilation Building and Duct Segment Location	47

LIST OF FIGURES (Cont.)

Figure No.	Description	Page
24	Affected Roadway Network - Roadway Link, Ramp, and Intersection Identification Map	63
25	Two-Lane Tunnel Concept - Affected Roadway Network - Roadway Link, Ramp, and Intersection Identification Map	64
26	Relocation Requirements - Area North of Dewey Square	95
27	Relocation Requirements - South Boston/South Bay Area	97
28	Relocation Requirements - Two-Lane Tunnel Concept - East Boston/Logan Airport	99
29	Land Use Impacts - South Boston	105
30	Land Use Impacts - North Station	113
31	Air Quality Receptor Locations	135
32	Existing Noise Measurement Locations	155
33	Historic Resources in the Project Area	172
34	Charles River Basin - Impacts	188
35	Paul Revere Landing Park Impacts	191
36	Impacts on the Causeway/North Washington Streets Historic District	196

LIST OF TABLES

Table No.	Description	Page
1	Property Requirements - Two-Lane Tunnel Concept	5
2	Tunnel Duct Sizing - Two-Lane Tunnel Concept	13
3	Ventilation Building Sizing - Two-Lane Tunnel Concept	15
4	Approximate Load Breakdown - Two-Lane Tunnel Concept	17
5	Electrical Energy Use In BTU/Year - Two-Lane Tunnel Concept	18
6	Total Annual Electrical Energy Use - Two-Lane Tunnel Concept	19
7	Preliminary Project Costs Estimate Two-Lane Tunnel Concept	20
8	Annual Equivalent Energy Consumed in BTU's	21
9	Summary of Construction-Related Energy Consumption (BTU's)	24
10	Average Weekday Daily Traffic (AWDT) 1982, 1990, 2010 - No-Build and the Two-Lane Tunnel Concept	55
11	Percentage Change Year 2010 AWDT; Two-Lane Tunnel Concept	56
12	Peak Hour Traffic Volumes 1982, 1990 and 2010	60
13	Peak Hour Volume-to-Capacity Ratio (V/C), Operating Speed (SP), and Level of Service (LOS) 1982, 1990, 2010	67
14	Level of Service Totals - Regional Highway Network	70
15	Level of Service Summary, Build Vs. No-Build Alternatives	72
16	Number of Hours of Congested Operation	73
17	Level of Service Comparisons - South Boston Intersections	74
18	Level of Service Comparisons - East Boston/ Revere Intersections	76
19	Level of Service Comparisons Downtown Boston Intersections	77

TABLE OF CONTENTS

		Page
1.0	Purpose for Evaluation	1
	1.1 Introduction	1
	1.2 Summary	1
2.0	Engineering Description	3
	2.1 Alignment	3
	2.2 Property and Utilities	4
	2.2.1 Summary of Properties Affected	4
	2.2.2 Utilities	4
	2.3 Construction Staging	9
	2.4 Geology and Soils	12
	2.5 Ventilation	12
	2.6 Power	12
	2.7 Costs	16
	2.8 Sunken Tube Tunnel Construction	16
	2.9 Energy	16
	2.9.1 Summary	16
	2.9.2 Conclusion	16
	2.9.3 Additional Analysis	22
	2.10 Design Criteria	23
	Figures 1 thru 23	25-47
3.0	Environmental Consequences	49
	3.1 Transportation	49
	3.1.1 Summary	49
	3.1.2 Traffic Volumes	53
	3.1.3 V/C Ratios and Levels of Service	66

		Page
3.1.4	Central Artery Bottlenecks and Congestion Points	75
3.1.5	Vehicle Miles, Vehicle Hours and Person Hours Travelled	81
3.1.6	Safety	82
3.1.7	Other Transportation Facilities	86
3.1.8	Construction Impacts	87
3.2	Relocation Impacts	94
3.2.1	Business/Government Agency Takings	94
3.2.2	Displaced Businesses and the Availability of Comparable Relocation Space	94
3.2.3	Related Business Economic Impacts	100
3.2.4	Community Economic Impacts	100
3.2.5	Massachusetts Department of Public Works Relocation Procedures	101
3.2.6	Other Possible Sources of Assistance	102
3.3	Land Use Impacts	103
3.3.1	Regionwide	103
3.3.2	Local Districts	104
3.3.3	Joint Development	117
3.4	Neighborhood and Community Facilities Impacts	118
3.4.1	No-Build Alternative	118
3.4.2	Two-Lane Tunnel Concept	118
3.5	Economic Impacts	122
3.5.1	Impacts on the Regional Economy	122
3.5.2	Impacts on the Project Area Economy	124
3.5.3	Impacts on Subarea Economies	125
3.5.4	Development and Related Fiscal Impacts	127
3.5.5	Measures to Minimize Adverse Effects	129

		Page
3.6	Air Quality	131
	3.6.1 Mesoscale Analysis	131
	3.6.2 Microscale Analyses	133
	3.6.3 Effects of Toll Plazas	136
	3.6.4 Tunnel Ventilation	138
	3.6.5 Effects of Ventilation Building Emissions	140
	3.6.6 Construction Impacts	149
3.7	Noise and Vibration	154
	3.7.1 Noise	154
	3.7.2 Vibration	163
3.8	Water Resources; Wetlands; Floodplains; Vegetation and Wildlife; Dredged and Excavated Material Disposal	167
3.9	Historical and Archaeological Impacts	168
	3.9.1 Impacts on Historic Resources	168
	3.9.2 Archaeological Effects	176
3.10	Aesthetic Impacts	178
3.11	Section 4(f) Evaluation	187
	3.11.1 Parklands	187
	3.11.2 Historic Resources	194
	3.11.3 Archaeological Sites	200
	3.11.4 Consultation	201

LIST OF FIGURES

Figure No.	Description	Page
1	Two-Lane Tunnel Concept, South Bay Area (Plan)	25
2	Two-Lane Tunnel Concept, South Bay Area (Profile)	26
3	Two-Lane Tunnel Concept, South Bay Area (Profile)	27
4	Two-Lane Tunnel Concept, Central Area (Plan)	28
5	Two-Lane Tunnel Concept, Central Area (Profile)	29
6	Two-Lane Tunnel Concept, North Area (Plan)	30
7	Two-Lane Tunnel Concept, North Area (Profile)	31
8	Two-Lane Tunnel Concept, North Area (Profile)	32
9	Two-Lane Tunnel Concept, South Boston Area (Plan)	33
10	Two-Lane Tunnel Concept, South Boston Area (Profile)	34
11	Two-Lane Tunnel Concept, South Boston Area (Profile)	35
12	Two-Lane Tunnel Concept, East Boston Area (Plan)	36
13	Two-Lane Tunnel Concept, East Boston Area (Profile)	37
14	Two-Lane Tunnel Concept - Typical Sections, East Boston Area	38
15	Two-Lane Tunnel Concept - Property and Utilities Plan South Bay Area	39
16	Two-Lane Tunnel Concept - Property and Utilities Plan Central Area	40
17	Two-Lane Tunnel Concept - Property and Utilities Plan North Area	41
18	Two-Lane Tunnel Concept - Property and Utilities Plan South Boston Area	42
19	Two-Lane Tunnel Concept - Property and Utilities Plan East Boston Area	43
20	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #1)	44
21	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #2)	45
22	Two-Lane Tunnel Concept - Stage, Construction, East Boston Area (Sequence #3)	46
23	Ventilation Building and Duct Segment Location	47

LIST OF FIGURES (Cont.)

Figure No.	Description	Page
24	Affected Roadway Network - Roadway Link, Ramp, and Intersection Identification Map	63
25	Two-Lane Tunnel Concept - Affected Roadway Network - Roadway Link, Ramp, and Intersection Identification Map	64
26	Relocation Requirements - Area North of Dewey Square	95
27	Relocation Requirements - South Boston/South Bay Area	97
28	Relocation Requirements - Two-Lane Tunnel Concept - East Boston/Logan Airport	99
29	Land Use Impacts - South Boston	105
30	Land Use Impacts - North Station	113
31	Air Quality Receptor Locations	135
32	Existing Noise Measurement Locations	155
33	Historic Resources in the Project Area	172
34	Charles River Basin - Impacts	188
35	Paul Revere Landing Park Impacts	191
36	Impacts on the Causeway/North Washington Streets Historic District	196

LIST OF TABLES

Table No.	Description	Page
1	Property Requirements - Two-Lane Tunnel Concept	5
2	Tunnel Duct Sizing - Two-Lane Tunnel Concept	13
3	Ventilation Building Sizing - Two-Lane Tunnel Concept	15
4	Approximate Load Breakdown - Two-Lane Tunnel Concept	17
5	Electrical Energy Use In BTU/Year - Two-Lane Tunnel Concept	18
6	Total Annual Electrical Energy Use - Two-Lane Tunnel Concept	19
7	Preliminary Project Costs Estimate Two-Lane Tunnel Concept	20
8	Annual Equivalent Energy Consumed in BTU's	21
9	Summary of Construction-Related Energy Consumption (BTU's)	24
10	Average Weekday Daily Traffic (AWDT) 1982, 1990, 2010 - No-Build and the Two-Lane Tunnel Concept	55
11	Percentage Change Year 2010 AWDT; Two-Lane Tunnel Concept	56
12	Peak Hour Traffic Volumes 1982, 1990 and 2010	60
13	Peak Hour Volume-to-Capacity Ratio (V/C), Operating Speed (SP), and Level of Service (LOS) 1982, 1990, 2010	67
14	Level of Service Totals - Regional Highway Network	70
15	Level of Service Summary, Build Vs. No-Build Alternatives	72
16	Number of Hours of Congested Operation	73
17	Level of Service Comparisons - South Boston Intersections	74
18	Level of Service Comparisons - East Boston/ Revere Intersections	76
19	Level of Service Comparisons Downtown Boston Intersections	77

LIST OF TABLES (Cont.)

Table No.	Description	Page
20	Individual Queue Length Comparisons by Alternative - Two-Lane Tunnel Concept vs. No-Build	78
21	Future Regional Highway System Accident Summary	83
22	Future Local Roadway System Accident Summary	84
23	Land Use Impacts - South Boston	106
24	Land Use Impacts - North Station	114
25	Total 24-Hour Emissions of Carbon Monoxide, Oxides of Nitrogen, and Nonmethane Hydrocarbons	132
26	Estimated Maximum One-Hour Carbon Monoxide Concentrations at Selected Receptor Locations	134
27	Estimated Maximum Eight-Hour Carbon Monoxide Concentrations at Selected Receptor Locations	137
28	Contributions of Toll Plaza Emissions to Maximum Eight-Hour Carbon Monoxide and One-Hour NO_2 Concentrations for Various Analysis Years	139
29	Estimated Maximum One-Hour Carbon Monoxide Concentrations in the Various Tunnels	141
30	Estimated Maximum One-Hour Nitrogen Dioxide Concentrations in the Various Tunnels	142
31	Contributions of Ventilation Building Emissions on One-Hour Nitrogen Dioxide Concentrations	144
32	Effects of Ventilation Building Emissions on Maximum One-Hour Nitrogen Dioxide Concentrations in the Immediate Vicinity of the Vents	145
33	Receptors that may be Affected by Noise from the Highway	156
34	Traffic Noise Summary Comparison of Alternatives, Without Noise Barriers, Year 2010	159
35	Benefit from Noise Barriers, for Sites Where Noise Barriers are Acoustically Feasible	161

1.0 PURPOSE AND EVALUATION

1.1 INTRODUCTION

The Two-Lane Tunnel Concept is a variant of the Preferred Alternative (Alternative 5A Modified). In the North Station area and on the Downtown Boston side of the Harbor, the Two-Lane Tunnel Concept, as described in this report, is similar to Alternative 6 in that it provides full northbound and southbound connections between the Central Artery and the Sumner and Callahan Tunnels; see Supplement to the Draft Environmental Impact Statement and Report (SDEIS/SDEIR) Ch. 2, pg. 17. In South Bay and the Fort Point Channel the Two-Lane Tunnel Concept is like Alternative 5A, and does not include a new Dorchester Avenue. In South Boston as far as the Toll Plaza and the EDIC interchange in Commonwealth Flats, the Two-Lane Tunnel Concept is similar to the Preferred Alternative, including the Northern Avenue interchange. North of the Toll Plaza, the single sunken tube Two-Lane Tunnel Concept follows the alignment of the Preferred Alternative across the Harbor and Bird Island Flats to a point in the vicinity of the Phase I development of the Massachusetts Technology Center. The alignment then avoids the Eastern Reservations Center and provides surface connections and ramps to and from the Airport Access and Egress Roads. The Two-Lane Tunnel Concept provides no further connections to Route 1A.

The Two-Lane Tunnel Concept was identified as a variation of the Preferred Alternative during the SDEIS/SDEIR analysis. It was studied in response to public concerns about East Boston neighborhood impacts, Bell Circle/Revere traffic impacts, and reduced tolls as a result of lower construction costs. The preliminary results reported in the SDEIS/SDEIR and continued public interest led to a commitment for a fuller study of the Two-Lane Tunnel Concept as part of the FEIS analyses.

This report provides a detailed assessment of the potential impacts of the Two-Lane Tunnel Concept; impact comparisons are made to the No-Build Alternative. Where its impacts or recommended measures to mitigate harm are identical to the Preferred Alternative, a cross reference has been provided.

1.2 SUMMARY

The basic findings are that the Two-Lane Tunnel Concept provides some traffic and other improvements compared to the No-Build Alternative in 1990 and 2010, but provides somewhat fewer traffic and other benefits than the Preferred Alternative. It does, however, represent an effective mid-term solution to the increased cross-harbor travel demands anticipated in the future.

The Two-Lane Tunnel Concept reduces construction impacts in East Boston but increases them in South Boston, the North End, and the Boston CBD, as compared to the No-Build Alternative. The absence of a Route 1A connection provides less relief to Central Artery traffic during construction of the depressed Artery. The extra ramps needed at the North End terminus of the Sumner/Callahan tunnels reduce tunnel capacity during construction; afterwards, they degrade pedestrian connections on the surface.

The Two-Lane Tunnel Concept is not quite as effective in removing traffic from local streets as the Preferred Alternative, but is significantly better than the No-Build Alternative since it does remove the High-Level Bridge bottleneck which causes extensive backups and causes traffic to divert to other roadways. As a result, while local economic activity and neighborhood air quality are significantly better than with the No-Build Alternative, they do not benefit as much as with the Preferred Alternative.

By the year 2010, continued

congestion on the Central Artery and the three harbor crossings will result in an increase of approximately 7.6 million vehicle hours of travel (VHT) and 68.6 million vehicle miles of travel (VMT), and a reduction of 10.3 million person hours of travel time (PHT) (versus a savings of 9.2 million VHT and 17.6 million PHT and an increase of 17.7 million VMT for the Preferred Alternative) over the No-Build Alternative. This somewhat reduced user benefit will have a slight dampening effect on the anticipated growth of businesses dependent on time-sensitive deliveries to the Airport, because access to Logan Airport and its internal operations would not be as improved as with the Preferred Alternative. East Boston Memorial Stadium would not be physically affected, but would experience somewhat worse noise and air quality impacts than with the Preferred Alternative. Impacts on the air quality and neighborhood cohesion of the North End, Jeffries Point and Maverick Square residential areas would continue because the existing inbound toll plaza would remain as the major access facility for the Airport.

The Two-Lane Tunnel Concept is estimated to cost approximately $500 million less than the Preferred Alternative. (If the Two-Lane Tunnel Concept included the South Bay features of the Preferred Alternative, the cost differential would be about $334 million.) It provides approximately 10,000 fewer on- and off-site jobs than the Preferred Alternative and, for the reasons described above, generates approximately $450 million less economic activity in the region.

The Two-Lane Tunnel Concept has smaller water quality impacts because the dredging requirements for a single, two-lane tube are less than for the four-lane Third Harbor Tunnel of the Preferred Alternative; elsewhere its impacts are similar to those of the Preferred Alternative. Business displacements, and hence, relocation impacts, are the same as with the Preferred Alternative except at the Airport, where no takings are involved north of the Airport Egress Road. Cultural resource impacts are also similar, except that the East Boston Memorial Stadium is not affected because no connections are made to Route 1A.

2.0 ENGINEERING DESCRIPTION

2.1 ALIGNMENT

This concept would provide the same basic modifications to the Central Artery as previously discussed with Alternative 5A of the Supportive Engineering Report of the Supplemental DEIS/DEIR, including carrying all northbound traffic in a new four-lane tunnel in the Fort Point Channel between the Massachusetts Turnpike interchange and north of the Dewey Square Tunnel, and depressing and widening the Central Artery north of the Dewey Square Tunnel. The Dewey Square Tunnel would be converted to southbound operation. Connections to and from the Callahan and Sumner Tunnels would be as described for Alternative 6 in the Supportive Engineering Report of the Supplemental DEIS/DEIR.

This concept also links the Massachusetts Turnpike/Central Artery interchange area in Boston with Logan Airport in East Boston via a tunnel through South Boston and Boston Harbor. The alignment of this tunnel is also called the Seaport Access Tunnel alignment, because it provides direct access from the regional highway system to the northern "seaport" sector of South Boston. The portion of the Seaport Access Tunnel from the Massachusetts Turnpike/Southeast Expressway to the vicinity of Summer Street would be a toll free tunnel. From Summer Street to Logan Airport, the Third Harbor Tunnel would be a toll facility. Plans and profiles for this alternative are presented on Figures 1 to 13. Typical sections are shown on Figure 14.

The Seaport Access Tunnel (two-way; four-lane, plus weaving lanes) would interchange with the Massachusetts Turnpike/Central Artery/Southeast Expressway in the South Bay area, crossing the south end of the Fort Point Channel and into South Boston. This tunnel crosses Gillette Company and Boston Wharf Company properties and passes under A Street, Summer Street, B Street, and Viaduct Street to an open two-way toll plaza in the Commonwealth Flats area (Massport property). From the toll plaza area, the roadway (two-way two-lane) enters a portal and curves toward the north, passing through Economic Development and Industrial Corporation (EDIC) property as it approaches Boston Harbor at the west edge of Boston Marine Industrial Park (BMIP).

The profile of the roadway as it crosses the end of the Fort Point Channel is set so the top of the tunnel structure is near the bottom of the existing Channel.

The following ramps to and from the Seaport Access Tunnel would be provided.

- Congress Street, with a surface street connection to Northern Avenue;
- Summer Street; and
- Northern Avenue.

The Summer Street and Northern Avenue on-ramps to the southbound tunnel would be toll free, providing free access to this facility by all vehicles. As in the Preferred Alternative, the purpose of this free access is to attract the trucks currently using local South Boston streets to use the higher quality Seaport Access Tunnel.

After passing to the west of the BMIP in South Boston, the Third Harbor Tunnel (two-way, two-lanes) approaches Boston Harbor and crosses directly to the Bird Island Flats area of Logan Airport, passing under the main shipping channels. The profile provides a minimum of 7 feet of clearance below the possible future 45-foot deep main shipping channel.

At Bird Island Flats, the two-lane tunnel continues in a northeast direction, providing tunnel

ramps to and from the Airport roadway system south of the East Boston Memorial Stadium. No direct connections to Route 1A are provided.

On the Boston side of the harbor, eight ventilation buildings are proposed in the vicinity of the tunnel portals in the South Bay area (just south of Dorchester Avenue), at A Street, Summer Street and C Street, and in the same locations along the depressed Central Artery as discussed for Alternatives 5A and 6. This alternative also includes a ventilation building at Bird Island Flats. Ventilation structures are expected to be approximately 100 feet high.

2.2 PROPERTY AND UTILITIES

2.2.1 Summary of Properties Affected

Table 1 identifies the total number of parcels affected by this concept, including the extent of partial and full acquisition area required. The location and title holder of each parcel of land in the study corridor is presented in Chapter 3.0 of the Supportive Engineering Report of the Final EIS/EIR.

2.2.2 Utilities

The following identifies the utilities, both public and private, which would be directly affected by this concept. As with all build alternatives, no long-term service disruptions would occur with the proposed construction. These utility impacts are nearly identical to the impacts of the Preferred Alternative. In East Boston, however, the utility impacts are less because the construction is limited to the Airport.

South Bay (Figure 15)

A 36-inch x 36-inch combined sewer outfall at Congress Street and Dorchester Avenue would be extended to the Fort Point Channel on the south side of Congress Street.

A 60-inch combined sewer outfall at Summer Street and Dorchester Avenue would be extended to the Fort Point Channel on the south side of Summer Street.

A 60-inch combined sewer overflow outfall on the easterly side of the Fort Point Channel at the Dorchester Avenue bridge would be connected to the proposed extension of the Roxbury Canal Conduit.

Force mains of 36-inch and 8-inch diameters from Massachusetts Turnpike Authority Pump House No. 7 in the South Bay would be relocated and connected to the proposed extension of the Roxbury Canal Conduit (see below).

The twin chamber (20-foot x 15.5-foot each) Roxbury Canal Conduit outfall into the Fort Point Channel would be extended from its present terminus at West Fourth Street to the vicinity of the South Postal Annex.

Existing utilities within the Boston Edison utility tunnel crossing the Fort Point Channel between Congress Street and Summer Street would be relocated onto the Congress Street bridge.

Telephone ducts located within the telephone submarine cable between Congress Street and Summer Street under the Fort Point Channel from Dorchester Avenue and Sleeper Street in South Boston would be relocated onto the Congress Street bridge.

16-inch and 24-inch water mains crossing Fort Point Channel from Dorchester Avenue at Congress Street to Northern Avenue in South Boston would be relocated onto the Congress Street bridge.

The 115,000 volt electric lines from Harrison Avenue, suspended on Broadway Bridge, crossing to South Boston at Dorchester Avenue would be relocated on a permanent utility bridge to be built parallel to the Broadway Bridge on its north side.

The 115,000 volt electric lines from Boston Edison sub-station,

Table 1

PROPERTY REQUIREMENTS
TWO-LANE TUNNEL CONCEPT

DESCRIPTION	NORTH AREA	CENTRAL AREA	SOUTH BAY AREA	SOUTH BOSTON	EAST BOSTON	TOTAL
Partial Takings	12	4	12	15	1	44
Complete Takings	2	17	4	5	-	28
Total Parcels Affected	14	21	16	20	1	72
Total Area Taken (Square Feet)	351,000	600,000	404,100	1,431,800	689,100	3,476,000

Note: Commonwealth of Massachusetts parcels, Massachusetts Turnpike Authority parcels, City of Boston Street Layouts, and takings within water bodies are not included.

crossing Fort Point Channel to South Boston near Northern Avenue would be relocated onto the new Northern Avenue bridge.

The 120-inch x 36-inch combined sewer outfall proposed by others in South Bay at Albany Street near Traveler Street would be extended to connect to the proposed extension of the Roxbury Canal Conduit.

A 30-inch intermediate pressure gas pipe crossing in the area of the Turnpike ramps and the railroad yard from Kneeland Street to Albany Street would be relocated in the same general vicinity.

The 32-inch x 54-inch East Side Interceptor combined sewer located in the vicinity of the railroad yards and crossing under the Turnpike ramps, would be relocated in the same general vicinity.

Telephone ducts in South Bay would be relocated onto the permanent Broadway utility bridge.

A 20-inch force main, proposed by others, crossing Albany Street at Broadway and running parallel to the north side of the Broadway bridge to the outfall in South Bay would be extended to connect to the Roxbury Canal Conduit extension.

The Gillette Company discharge in South Boston would be extended on land along the east side of the Fort Point Channel running in a northerly direction to a new channel outfall located approximately 100 feet north of Mount Washington Avenue.

The MBTA Tower Interlock Communications Systems in South Bay would be rebuilt in the vicinity of the present location.

Massachusetts Turnpike Authority (MTA) Pump House No. 7 would be relocated to the east and in the same general vicinity.

The MBTA pump house and tidal drain reservoir in the railroad yard adjacent to Broadway is expected to be abandoned by others.

Central Area (Figure 16)

The 66-inch sewer at Milk Street from the Surface Artery southbound to Atlantic Avenue would be replaced by the Milk Street sewer siphon in the same general vicinity.

The 84-inch storm drain at Milk Street from the Surface Artery southbound to Atlantic Avenue would be replaced by the Central Street drain siphon in the same general vicinity.

The East Side Interceptor at Atlantic Avenue and Northern Avenue would be relocated from Atlantic Avenue and Foster's Wharf to the Fort Point Channel running southerly along the pierhead line to Northern Avenue and connecting at Atlantic Avenue.

The existing 42-inch sewer at Commercial Street from Clinton Street to Cross Street would be removed and replaced by a 42-inch sewer running along the easterly side of the Central Artery to the south and connecting at Milk Street and the East Side Interceptor.

The 66-inch drain at Commercial Street from Clinton Street to Cross Street would be relocated in the same general vicinity.

The West Side Interceptor at Causeway Street from Haverhill Street to Medford Street would be relocated from Causeway Street, paralleling the Central Artery on the westerly side, crossing under the Central Artery approximatley 350 feet north of Causeway Street, and then running parallel to the Central Artery along the easterly side of the Central Artery to the connection with the existing West Side Interceptor at Causeway Street.

The 30-inch drain at Cross Street and Commercial Street would be relocated in the same general vicinity.

The 96-inch drain at Commercial Street and Cross Street would be relocated in the same general vicinity.

The 30 x 36-inch sewer at Traverse Street and North Washington

Street would be connected to the New Traverse Street sewer.

A portion of the East Side Interceptor at Atlantic Avenue from Milk Street to south of India Street would be relocated in the same general vicinity.

The 60-inch storm drain at Commercial Street from Clinton Street to Atlantic Avenue would be removed.

The 30 x 36-inch sewer at Hanover Street from Blackstone Street to Cross Street and the 30 x 36-inch sewer at Sudbury Street from Blackstone Street to Cross Street would be replaced by a 36-inch sewer from Hanover Street at Blackstone Street, running northerly along the westerly side of the tunnel to Sudbury Street and then crossing over the top of the Central Artery tunnel to connect with the 66-inch sewer at Cross Street.

The 72-inch Purchase Street sewer/outfall from Congress Street to Oliver Street crossing the Central Artery to the Fort Point Channel would be relocated along Purchase Street and crossing the Central Artery to Foster's Wharf and to the Fort Point Channel outfall.

The two 60-inch pipes (inverted sewer siphon) at Traverse Street from Canal Street to Haverhill Street under the Orange Line, the 102-inch sewer from Traverse Street to North Washington Street and the 57 x 60-inch sewer from North Washington Street to Cross Street would be replaced by the New Traverse Street sewer beginning at Canal Street and crossing under the Green Line tracks, over the Orange Line tunnel and running along the easterly side of the tunnel to Sudbury Street. At Sudbury Street it would connect with a 66-inch sewer and continue to North Street to connect with a 96-inch sewer at Fulton Street.

The 30-inch gas main at Cross Street and Commercial Street would be relocated from Clinton Street to Cross and Commercial Streets.

The 30-inch gas main at Purchase Street from India Street to High Street would be relocated to the westerly side of the tunnel from India Street to High Street.

The telephone cables at State Street from the Surface Artery southbound to Atlantic Avenue would be replaced in the same general vicinity as the existing cables.

The 115,000 volt electric lines at Causeway Street from Haverhill Street to Medford Street would be relocated in the same general vicinity.

The 115,000 volt electric lines at Purchase Street and Oliver Street crossing the Central Artery to the Boston Edison substation near the Harbor Plaza building would be relocated along Purchase Street, crossing Congress Street to Atlantic Avenue and then connecting to the Edison substation near Harbor Plaza.

The Boston Edison substation on Atlantic Avenue near Congress Street may have to be reconfigured during construction.

MDPW Pump Houses No. 1, No. 2, No. 4, and No. 5 would be replaced by the new tunnel drainage system.

MDPW electrical substations would be removed and replaced by the new tunnel electrical system.

MBTA substation at Traverse Street would be removed and replaced by the Central Artery construction.

North Area (Figure 17)

The Boston - Cambridge, "A" cable telephone conduits at Leverett Circle would be maintained in service and supported on a temporary utility bridge in their existing location.

The twin 48-inch combined sewer (CS) siphon at the Leverett Circle underpass would have to be extended for a distance of approximately 100 feet.

The river crossing structure for the 84-inch Charles River CS Marginal Conduit would be relocated approximately 35 feet closer to the river. The 48-inch and 84-inch CS inflow pipes would have to be relocated for a length of about 100 feet each. The 54-inch overflow pipe from the Lowell Street weir structure would be relocated for a length of about 150 feet to the Charles River.

A 36-inch water main running parallel to Interstate Route 93 northbound would be relocated for a length of about 700 feet parallel to its existing location and outside the limits of the bridge pier foundations.

A 36-inch water main from Causeway Street to the north would be relocated parallel to proposed Ramp W-CN.

A bank of thirty-six 4-inch telephone ducts from Causeway Street to the north would be relocated parallel to proposed Ramp CS-W.

South Boston (Figure 18)

The 72-inch storm drain at Mt. Washington Avenue would be rebuilt as it passes over the mainline tunnel.

In A Street, a 54-inch storm drain, 24-inch sanitary sewer, 16-inch water line and 16 telephone ducts would be relocated in close proximity to their existing locations.

At Summer and Congress Streets, 115,000 volt electric lines would be relocated in the approximate vicinity of their existing locations.

A 30-inch sanitary sewer would be relocated from Trilling Way and Northern Avenue to the Massport haul road, running in a southerly direction toward Summer Street.

Approximately 250 feet of 115,000 volt electric lines in the Massport haul road would be relocated in the same general vicinity.

Electric and telephone conduits in the haul road and Northern Avenue Area would be relocated in the same general vicinity.

Electric and telephone conduits in C Street between 7th and 8th Streets would be relocated in the same general vicinity.

In Northern Avenue between the Massport haul road and 8th Street, the following utilities would be relocated in the same general vicinity: a 16-inch gas main, two 16-inch water lines, and an 18-inch sewer.

East Boston - Airport Property (Figure 19)

A 60-inch storm drain located in the vicinity of the General Aviation Building would be relocated in the same general vicinity.

An 8-inch sanitary force main located along the easterly side of the General Aviation Building would be relocated in the same general vicinity.

A 10-inch fuel line in the vicinity of the Porter Street outfall would be relocated in an easterly direction parallel to the proposed tunnel.

A portion of the existing 10-foot x 10-foot drain in Bird Island Flats would be relocated as it passes over the mainline tunnel.

The 10-foot x 12-foot Porter Street outfall would be relocated from a point just west of the Hill Air Cargo building, running in a southerly direction along the west side of the mainline tunnel toward Bird Island Flats where it would connect with the existing twin 10-foot x 12-foot drain.

A 12-inch water main near the southerly end of the Eastern Air Freight Building would be relocated in the same general vicinity.

The 18-inch sewer located near the Hilton Hotel would be relocated in the same general vicinity.

The 8-inch fuel oil pipeline located near the Eastern Air Freight

building would be relocated close to its present location.

2.3 CONSTRUCTION STAGING

The stage construction scheme for the Two-Lane Tunnel Concept is based on the same assumptions presented in the Supportive Engineering Report of the Supplement to the Draft EIS/EIR for Alternative 5A in the South Bay, South Boston, and North Areas, and for both Alternatives 5A and 6 in the Central Area. For clarification, these assumptions are presented below. Construction staging plans for the South Bay, Central, North, and South Boston Areas have not been reproduced as they have not changed since the SDEIS/SDEIR. The analysis does not include the South Bay interchange of the Preferred Alternative.

South Bay Area

(1) The South Bay Area construction would be timed so that the completion of the Cross Harbor Tunnel, East Boston (Airport) and South Bay Areas would occur simultaneously.

(2) The Central Artery would be continuously maintained as 3 lanes in each direction.

(3) All of the bridges crossing the Fort Point Channel except the new Northern Avenue Bridge would be affected by the tunnel construction. To minimize traffic impacts during construction, only one bridge at a time would be reconstructed and a temporary bridge would be used in its place until the permanent structure is re-opened.

(4) The new Northern Avenue and West Fourth Street Bridges would be designed and built as separate projects, and would accommodate the Third Harbor Tunnel/Depressed Central Artery project.

(5) A temporary ("wye connector") would be built to maintain rail service during the construction period when the existing wye connector is shut down.

(6) During construction, the same number of tracks as exist today would continuously be maintained into South Station (5) and across the Dorchester Branch railroad bridge (2) over Fort Point Channel.

(7) The Broadway Bridge will accommodate the MBTA's needs, including possible commuter rail service or a reconfiguration of MBTA Red Line trackage.

(8) Ramp connections to the Central Artery and Massachusetts Turnpike would be maintained at all times.

(9) Access to the South Postal Annex would be maintained at all times.

(10) The MBTA Red Line in the Fort Point Channel would be continuously maintained.

Central Area

(1) All of the work associated with depressing the Central Artery from the Dewey Square Tunnel to Causeway Street would be sub-divided into five major construction areas.

(2) Phase One in each of the five construction areas would consist of temporary and permanent relocation of utilities and roadways which cross the proposed slurry wall construction into 150-foot minimum block lengths to facilitate slurry wall construction.

(3) Phase Two in each of the five construction areas would consist of constructing slurry walls, grade beams, underpinning, excavation, tunnel construction and backfill.

(4) Phase Three in each of the five construction areas would consist of removal and disposal of the existing Central Artery structure.

(5) Start of construction for each of the five construction areas would be delayed by two months to allow for the orderly mobilization of each of the General Contractors.

(6) Half of the existing Surface Artery, (three lanes minimum) would be

available for local access at all times; the remaining three lanes to be available to the Contractor for transport of construction materials. Parking along the Surface Artery and Atlantic Avenue would not be permitted during construction.

(7) The existing Surface Artery would be restored with pre-cast concrete slabs immediately after slurry wall grade beams and underpinning operations are complete.

(8) Parking areas under the existing Central Artery and the landscaped area adjacent to Atlantic Avenue may be used as staging and access areas for the Contractor. Demolition of existing buildings (Anelex - U.S. Customs - Charles River Buildings) would be executed immediately to provide additional staging areas to the Contractors. The use of the precast Surface Artery decks as staging areas would not be allowed.

(9) All excavation and tunnel box construction activities would be performed under the existing Surface Artery deck. Access to the below grade construction to each adjacent contract (by each of the Contractors) would be continuously maintained.

(10) Construction would be phased in such a manner to:

a. Maintain six lanes of the elevated Central Artery during the construction of the Depressed Central Artery.

b. Maintain six express lanes of traffic in the Depressed Central Artery and reserve the elevated Central Artery as a collector-distributor road for local access.

c. After local connections are made to the Depressed Artery, remove traffic from the elevated Artery and then remove the elevated structure.

(11) Connections between the existing elevated and proposed Depressed Central Artery and the: Sumner and Callahan Tunnels; Atlantic Ave.; Purchase Street, and Leverett Circle would be maintained at all times.

(12) A combination of three travel lanes in the Sumner and Callahan Tunnel would be maintained at all times during construction of local access ramps.

(13) The Quincy Market Garage would be underpinned, however, a one month shut down is required for the initial underpinning operation.

(14) The Atlantic Building would be underpinned. However, tenants must be vacated for one year.

(15) Service on the MBTA Blue Line in State Street and the Orange Line adjacent to Canal Street would be continuously maintained.

(16) Before the existing Central Artery portal at Congress Street is reconstructed, the new tunnel in Fort Point Channel would be available for rerouting of traffic. Also, the Two-Lane Third Harbor Tunnel would be available for traffic movement to the Airport.

(17) The Harbor Plaza Building would be underpinned and tenants would be able to remain during construction.

(18) The Congress Street northbound on-ramp would not be closed until the proposed Central Artery on-ramp from Atlantic Avenue is built.

(19) The High Street off-ramp would be removed only after the proposed Purchase Street off-ramp is functional.

(20) Atlantic Avenue (one way) would have one lane open at all times in the area of tunnel construction.

(21) During construction of the southbound Central Artery at the existing Congress Street portal, traffic would temporarily be unable to reach the existing Massachusetts Turnpike ramp at the southern end of the Dewey Square Tunnel; a temporary modification at the Turnpike (Ramp A-B) would be used to maintain service.

North Area

(1) Construction of the proposed Central Artery North Area Project (by others), including the connectors to the Mystic-Tobin Bridge, would be completed prior to the start of construction for the Depressed Central Artery. In addition, certain modifications were assumed to be made in the North Area Project to accommodate construction of a Depressed Central Artery.

(2) Completion of the North Area and Depressed Central Artery projects would occur simultaneously.

(3) Three lanes of Interstate Route 93 (south of the Mystic-Tobin Bridge connection) and ramp access to the Mystic-Tobin Bridge and City Square would be continuously maintained. Two lanes of I-93 (north of the Mystic-Tobin Bridge connection) would be continuously maintained.

(4) Ramp service from I-93 to and from Leverett Circle would not be available for one year. (Detour would consist of Charles River Dam, Gilmore Bridge and Rutherford Avenue or Causeway Street, Martha Way, and Lomasney Way).

(5) Ramp S-CN (Leverett Circle to I-93 N.B.) would not be built until the High-Level Bridge is removed.

(6) Proposed I-93 northbound and southbound would be constructed from the Gilmore Bridge to Causeway Street prior to removing the existing I-93 double deck structure.

(7) During construction ten tracks would continuously be maintained into North Station.

(8) Unused bridge decks resulting from modifications to I-93 would be removed.

(9) Vehicular access to the MDC Dam would be maintained. Parking would not be available during construction.

(10) The railroad spur to Stop and Shop would not be available during construction.

(11) A minimum of two lanes through Leverett Circle would be maintained at all times.

(12) Vehicular access to the Registry of Motor Vehicles building and the Spaulding Rehabilitation Hospital would be maintained at all times.

(13) Service on the MBTA Orange Line under I-93 and MBTA Green Line at Leverett Circle would be continuously maintained.

(14) Access through the MDC locks at the Charles River Dam would be maintained.

South Boston

(1) R.R. access (one track) to the Army Base would be maintained at all times during construction. After construction two additional tracks may be accommodated.

(2) A minimum of four lanes on Summer Street would be continuously maintained during construction by means of a temporary bridge.

(3) Temporary vehicular routes would be constructed at A Street, B Street, Viaduct Street, Ramp Street and Northern Avenue.

(4) Relocated Northern Avenue from "B" Street to Atlantic Avenue would be completed by others prior to the start of the Third Harbor Tunnel construction.

(5) Suitable materials excavated during the cut-and-cover operation in South Boston would be used as fill in the South Bay Area.

Boston Harbor

(1) Half of the 1200-foot wide shipping channel would remain open to navigation at all times.

(2) During the tunnel sinking operations (approx. one day) the channel should be closed to navigation.

(3) Dredging operations would be constrained in the Harbor during flounder spawning season.

(4) Dredging operations would be coordinated with recreational boating activities, with fishing activities and with luxury cruise ship activities.

(5) The fire boat formerly berthed in Jeffries Cove would be at its new location at Bird Island Flats.

Stage construction plans for the East Boston Area have been developed and are shown in Figures 20 to 22. The following assumptions pertain to the East Boston Area:

(1) The same number of lanes that exist today on the Airport roadways would be maintained at all times.

(2) Access to Bird Island Flats (BIF), although disrupted during the entire construction phase, would be maintained.

(3) Aircraft access to the Eastern Airlines Terminal and Hangar would be maintained by means of constructing a temporary satellite terminal and relocating the taxiway.

2.4 GEOLOGY AND SOILS

The principal geotechnical factors affecting construction of this concept are identified in Chapter 5.0 of the Supportive Engineering Reports of the Supplemental Draft EIS/EIR and the Final EIS/EIR. The sections to reference are as follows:

Area	Alternative
South Bay	Alternative 5A
Central	Alternatives 5A/6
North	Alternative 6
South Boston/ Boston Harbor	Preferred Alternative
East Boston	Preferred Alternative

2.5 VENTILATION

The ventilation analysis for the Two-Lane Tunnel Concept is based on the same parameters presented in the Supportive Engineering Reports of the Draft and Supplement to the Draft EIS/EIR. Except for tunnels served by Vent Building 8, the transverse system of air ventilation would be used throughout. In such a system, fresh air is supplied at roadway level, and vitiated air is exhausted through ports in or near the ceiling. Supply and exhaust ducts may be below the roadway, above the ceiling or on the sides. In limited headroom areas (i.e., State Street) the exhaust and/or supply ducts were eliminated for short distances of tunnel in order to provide for the necessary vertical clearance between the ground surface and the tunnel structure. In cases where the exhaust ducts are eliminated, the ventilation system becomes "semi-transverse". It is generally assumed that the air supply portion of the ventilation system would use individually ducted segments with sensor operated baffles at the fan room to ensure even air pressure throughout the entire tunnel length. Tunnels served by Vent Building 8 would be vented by a longitudinal system in which exhaust fans in a shaft or adit near the center of the tunnel exhaust vitiated air drawn through the respective tunnels from their portals. The tunnel duct sizing and the ventilation building sizing are presented on Tables 2 and 3. The approximate ventilation building locations for the Two-Lane Tunnel Concept are shown on Figure 23. It should be noted that the ventilation building locations shown are approximate; the exact locations cannot be determined until after additional air quality modeling and analysis to assure conformance with Federal and State air quality requirements.

2.6 POWER

The power requirements for the Two-Lane Tunnel Concept are based on the same parameters presented in the Supportive Engineering Reports of the Draft and Supplement to the Draft EIS/EIR. The approximate load breakdown, energy requirements and costs for the Two-Lane Tunnel Concept are presented on Tables 4, 5 and 6.

Table 2

TUNNEL DUCT SIZING

TWO LANE TUNNEL CONCEPT

Alt.	Tunnel Segment	Length	No. of Lanes	Supply Air (KCFM)	Duct Size (sf) Supply	Duct Size (sf) Exhaust
	A-0	300	1*	30	6*	6*
2-LANE	A-0	300	1*	30	6*	6*
THIRD	A-0	700	1*	70(130)	14(26)*	14(26)*
HARBOR	A-0	400	1*	40	8*	8*
TUNNEL	A-0-SBD	300	2	60(230)	12(46)	12(46)
CONCEPT						
	A-0-NBD	700	1	70	14	14
	A-0	500	1*	50	10*	10*
	A-0	300	1*	30	6*	6*
	A-0	200	1	20(100)	4(20)	4(20)
	A-0-NBD	700	5	350	70	70
	A-0	500	1	50	10	10
	J-0	1575	5*	790	158*	158*
	J-0-NBD	300	3	90(880)	18(176)*	18(176)*
	J-0	500	1	50	10	10
	B-0-SBD	300	2	60	12	12
	B-0	100	1	10	2	2
	B-0-NBD	400	2*	80	16*	16*
	B-0	300	5	150(1110)	30(222)	30(222)
	B-0	400	1	40	8	8
	B-7-SBD	700	3	210	42	42
	B-7-SBD	400	2	80	16	16
	B-7-NBD	800	2	160	32	32
	B-7-NBD	400	3	120	24	24
	B-7	500	1	50	10*	10*
	B-7	900	1	90	18*	18*
	B-7	600	2	120	24(52)	24(52)
	B-8-NBD	1400	2	420	LONGITUDINAL	
	B-8	550	1	17	TUNNEL	
	B-8-SBD	1400	2	420		
	B-8	700	1	105	VENTILATION	
	B-9-NBD	750	1	75	15	15
	B-9-SBD	750	1	75	15	15
	C-9-NDB	1900	1	190	38	38
	C-9-SBD	1900	1	190	38	38
	C-10-NBD	1900	1	190	38	38

* Denotes not connected directly to Vent Building, i.e., connection via ductwork of other ramps or mainline tunnel.

( ) This quantity required to serve this link as well as the more remote links connected thereto.

Table 2 (continued)

C-10-SBD	1900	1	190	38	38
D-10-NBD	3000	1	300	60	60
D-10-SBD	3000	1	300	60	60
J-1-NBD	1575	5	790	158	158
E-1-NBD	540	5	270	54	54
E-1-SBD	500	5	250	50	50
E-3	400	1*	40	8*	8*
E-3-NBD	360	5*	180	36*	36*
E-3-NBD	100	5	220(270)	44(54)	44(54)
E-3-NBD	500	5	250	50	50
F-3-NBD	850	5	425	85	85
F-3-SBD	850	5	425	85	85
F-4-NBD	850	5	425	85	85
F-4	900	1*	90	18	18
F-4-SBD	600	5	300(390)	60(78)	60(78)
G-4-NBD	1500	5	750	150	150
G-4-SBD	1600	5	800	160	160
G-5	200	1*	20	4*	4*
G-5	250	2*	50	10*	10*
G-5	800	1*	80(150)	16(30)*	16(30)*
G-5-NBD	700	5	350(500)	70(100)	70(100)
G-5	200	1*	20	4*	4*
G-5	400	2*	80	16*	16*
G-5	1500	1*	150(250)	30(50)*	30(50)*
G-5-SBD	800	5	400(650)	80(130)	80(130)
H-5-NBD	1000	2	200	40	40
H-5-NBD	2800	2	560	112	112

* Denotes not connected directly to Vent Building, i.e., connection via ductwork of other ramps or mainline tunnel.

( ) This quantity required to serve this link as well as the more remote links connected thereto.

Table 3

VENTILATION BUILDING SIZING
TWO-LANE TUNNEL CONCEPT

Ventilation Buildings	Vent-0	Vent-1	Vent-3	Vent-4	Vent-5	Vent-7	Vent-8	Vent-9	Vent-10
SUPPLY AIR FLOW K-CFM	2070	1830	1335	2190	1910	690	960	530*	1080*
TOTAL AIRFLOW SUP & EXH K-CFM	4140	3660	2670	4380	3820	1380	960	1060*	2120*
LOUVER INTAKE									
@ 5 MPH	4704	4158	3034	4977	4340	1568	2180	2410	4810
@ 7.5 MPH	3136	2772	2022	3318	2895	1045	1454	1610	3210
BLDG CORE FT^2	1400	1200	900	1500	1300	600	330	700	1400
CORE SIZE	60x24	60x20	60x15	75x20	60x25	24x24	19x19	60x12	60x24
TOTAL FANS	12	11	8	13	11	5	4	3*	6*
FANS/FLOOR	4	4	3	5	4	3	4	3	4
MECH ROOM FT^2	4800	4800	3300	6000	4800	3600	4800	3600	4800
MECH RM SIZE	60x75	60x80	60x55	75x80	60x80	-	-	60x60	60x75
BLDG SIZE	60x100	60x100	60x70	75x100	60x105	60x70	75x75	60x72	60x100
TOTAL BLDG FLOOR AREA FT^2	24,000	24,000	16,800	30,000	25,200	12,600	11,250	13,000	24,000
STACK AREA FT^2	1035	915	670	1095	955	345	480	580	1060
HEIGHT-STORIES OF 25 FT.	4	4	4	4	4	3	2	3	4
TOP OF STACK ABOVE GROUND	110	110	110	110	110	85	60	85	110

2.7 COSTS

The cost of this concept is estimated at $2.066 billion, including property acquisition costs.

These total project costs are based on the parameters presented in the Supportive Engineering Reports of the Draft EIS/EIR, Supplement to the Draft EIS/EIR, and the Final EIS/EIR. The costs developed for this concept are presented in Table 7. For comparison purposes, the total cost of the Preferred Alternative (which includes the four-lane Third Harbor Tunnel), is approximtely $2.6 billion.

2.8 SUNKEN TUBE TUNNEL CONSTRUCTION

The sunken tube tunnel construction for this concept is based on the same assumptions presented in the Supportive Engineering Reports of the Draft EIS/EIR and the Final EIS/EIR. The sunken tube cross section, as proposed for this Two-Lane Tunnel Concept, is presented on Figure 14. The length of the sunken tube is about 4,000 feet.

2.9 ENERGY ANALYSIS

2.9.1 Summary

The energy study analyzed the daily energy consumption of the No-Build Alternative and the Two-Lane Tunnel Concept, using average daily traffic figures projected for the year 2010.

The consumption of energy was calculated using "Energy Requirements for Transportation Systems," U.S. Department of Transportation, Federal Highway Administration, Office of Environmental Policy, June 1980. These guidelines suggest a two-part approach involving both direct and indirect energy use.

Direct energy use involves the direct consumption of fuel based on traffic-related and facility-related factors. Traffic-related factors include volume of traffic, speed, traffic flow characteristics, and composition of vehicle types. Facility-related factors include grade, curvature, pavement condition, and stops (signs and signals). Indirect energy consumed by this facility is related to the materials and operations required for construction, including transport, and the energy consumed by operation and maintenance of the facility. Any build alternative requires a substantial one time energy expenditure related to the construction materials, operations, and equipment. It also requires maintenance after construction. Indirect energy also includes that energy used to manufacture vehicles and energy consumed as a result of wearout and maintenance related to their operation. A proportionate quantity of the total energy required to manufacture and maintain vehicles is also assigned to the project being evaluated.

Table 8 provides the results of the energy analysis in terms of equivalent annual energy consumption for the year 2010. Construction energy and vehicle indirect energy values were pro-rated according to estimated "useful lives", thus providing meaningful comparisons.

2.9.2 Conclusion

The results in Table 8 indicate that the Two-Lane Tunnel Concept is somewhat less energy efficient than the No-Build Alternative, as it uses the equivalent of about 399 additional barrels of crude oil per year. The build option results in increased traffic volumes on the regional highway network as a result of reduced average vehicle occupancy rates. The Two-Lane Tunnel Concept is more energy efficient than the No-Build Alternative because it provides increased north-south and east-west vehicular capacity and improved traffic operations, due to the widened Central Artery and replacement of the existing High-Level Bridge bottleneck, and the Two-Lane Third Harbor Tunnel. The additional capacity provided by these two specific improvements is enough to cause many motorists to remain on these roadways rather than

Table 4

APPROXIMATE LOAD BREAKDOWNS (kVA)
TWO-LANE TUNNEL CONCEPT

ITEM	VENT BUILDING V_o	V_1	V_3	V_4	V_5	V_7	V_8	V_9	V_{10}	Admin.
VENT FANS - 480V*	1200	1100	800	1300	1100	800	400	300	600	-
VENT FANS-2300V*	4200	3850	2800	4550	3850	2800	1400	1050	2100	-
PUMPING	141	141	141	141	141	141	141	141	141	-
TUNNEL LIGHTING	684	684	684	684	684	684	684	684	684	-
BUILDING SERVICES	165	165	115	206	173	115	77	89	216	195
TOTAL 480V LOAD	2190	2090	1740	2331	2098	1740	1302	1214	1641	195
TOTAL 2300V LOAD	4200	3850	2800	4550	3850	2800	1400	1050	2100	-
TOTAL LOAD	5120	4840	3740	5581	4848	3740	2302	1964	3141	195

TOTAL LOAD 35,541 kVA

*Not Coincidental

Table 5

ELECTRICAL ENERGY USE IN BTU/YEAR
TWO-LANE TUNNEL CONCEPT

	KW-h	BTUx106
VENTILATION	31,141,800	106,318
TUNNEL LIGHTING	33,726,000	115,132
BUILDING SERVICES	3,603,650	12,303
PUMPING	847,165	2,892
TOTAL	69,318,615	236,645

Table 6

TOTAL ANNUAL ELECTRICAL ENERGY USE

TWO LANE TUNNEL CONCEPT

TOTAL ENERGY USE PER YEAR	
VENTILATION	
ENERGY (kW-h)	31,141,800
DEMAND (kW)	20,736
TUNNEL LIGHTING	
ENERGY (kW-h)	33,726,000
DEMAND (kW)	6,159
BUILDING SERVICES	
ENERGY (kW-h)	3,603,650
DEMAND (kW)	1,515
PUMPING	
ENERGY (kW-h)	847,165
DEMAND (kW)	1,045
TOTALS	
ENERGY (kW-h)	69,318,615
DEMAND (kW)	29,455
COSTS (MAY 1982 RATES, $)	
VENTILATION	
ENERGY (kW-h)	$ 2,008,644
DEMAND (kw)	975,240
TUNNEL LIGHTING	
ENERGY (kW-h)	2,175,327
DEMAND (kW)	287,315
BUILDING SERVICES	
ENERGY (kW-h)	232,435
DEMAND (kW)	70,721
PUMPING	
ENERGY (kW-h)	54,642
DEMAND (kW)	48,773
TOTALS	
ENERGY (kW-h)	4,471,048
DEMAND (kW)	1,382,049
TOTAL COST	$ 5,853,097

Table 7

TWO-LANE
TUNNEL CONCEPT

PRELIMINARY PROJECT COST ESTIMATE

CONSTRUCTION ITEMS	NORTH AREA	CENTRAL AREA	SOUTH BAY AREA	SOUTH BOSTON	BOSTON HARBOR	EAST BOSTON	TOTA
Tunnel Structures	32	182	138	107	85	50	594
Ventilation Buildings & Equipment	7	14	11	17	-	8	57
Toll Facilities & Equipment	-	-	-	4	-	-	4
Grade-Separated Structures	86	19	41	44	-	5	195
Lateral Support & Underpinning	36	279	68	37	-	37	457
Earthwork	11	101	38	42	23	17	232
Dredging	-	-	-	-	5	-	5
Roadways at Grade	2	6	3	3	-	2	[illegible]
Utility Relocations	4	42	39	6	-	5	96
Miscellaneous	14	31	59	7	3	13	127
CONSTRUCTION TOTAL	192	674	397	267	116	137	178
Engineering & Contingencies (10%)	19	67	40	27	12	14	17
Right-of-Way	43	8	13	33	-	7	10
TOTAL COSTS	254	749	450	327	128	158	2066

Costs in Millions of Dollars
(July of 1982)

Table 8

ANNUAL EQUIVALENT ENERGY CONSUMED (BTU's)

Direct Energy	No-Build Alternative	Two-Lane Tunnel Concept
Cars	9.115×10^{12}	8.792×10^{12}
2-Axle, 6-Tire Trucks	3.637×10^{12}	3.510×10^{12}
Tractor-Semitrailer Trucks	3.017×10^{12}	2.913×10^{12}
Total, Direct Energy	15.77×10^{12}	15.22×10^{12}
Indirect Energy		
Vehicle-related	16.32×10^{12}	16.19×10^{12}
Facility Construction	0.036×10^{12}	0.431×10^{12}
Facility Maintenance	0.001×10^{12}	0.008×10^{12}
Power	0	0.237×10^{12}
Total, Indirect Energy	16.36×10^{12}	16.86×10^{12}
Total Energy Expended Annually:	32.13×10^{12}	32.09×10^{12}
Total energy in terms of equivalent barrels of crude oil per day:	15,177 Bbl	15,158 Bbl

to seek longer alternative travel paths. Increases in energy consumption for the Two-Lane Tunnel Concept, however, are only 2.6 percent of the energy consumed for the No-Build Alternative, because of the energy expended to construct and operate the new facilities.

2.9.3 Additional Analysis

Traffic

The following summarizes traffic data contained in Section 3.2 of this report as used in the energy analysis.

YEAR 2010 ANNUAL VEHICLE-MILES AND VEHICLE-HOURS OF TRAVEL

Alt.	Vehicle-Miles	Vehicle-Hours
No-Build	3.3 billion	150.1 million
Two-Lane Tunnel Concept	3.4 billion	157.7 million

The following percentages were used in the computation of Direct Energy and vehicle-related Indirect Energy.

Breakdown of Annual traffic* by vehicle types**:

Cars	85%
2 Axle, 6 Tire Trucks	10%
Tractor Semi-Trailer Trucks	5%

* Annual Vehicle-miles from CTPS Computer Programs (Year 2010).

** References: DEQE, Mobile Source Emission Inventory Data (2010).

Breakdown of Cars and Trucks by fuel type (Year 2010):

Cars, Gasoline	80%
Cars, Diesel	20%
2 Axle, 6 Tire Trucks, Gas	78%
2 Axle, 6 Tire Trucks, Diesel	22%
Tractor Semi-Trailer Trucks, Gas	50%
Tractor Semi-Trailer Trucks, Diesel	50%

Reference: DEQE

Data presented above represents Traffic Zones 1 and 2 as described in Appendix 4 of the DEIS (December 1982). These zones are bounded roughly by Newton to the west, Malden and Revere to the north and Milton to the south. Within this area, overall vehicle miles of travel have increased with the Two-Lane Tunnel Concept for reasons discussed in Section 2.9.2 above. Vehicle hours of travel have also increased, and therefore indicate an overall travel time increase of approximately five percent over the No-Build Alternative.

Indirect Energy

The calculations for power requirements for the No-Build Alternative and the Two-Lane Tunnel Concept summarized in Table 8 include Ventilation, Tunnel Lighting, Building Services and Pumping requirements.

Peripheral energy change recognizes energy resources that are not used in any manner by the system itself. Rather, it addresses the potential effect that a transportation system may have on energy use and availability in the area it services.

Peripheral energy consumption effects for the Two-Lane Tunnel Concept would be negligible, since the project:

1. is located in a heavily built-up area with very little area left for induced development;

2. would not increase traffic volumes by significant levels;

3. would not pre-empt use of other transportation modes;

4. would not cause a significant shift in population density; and,

5. would have a minimum encroachment upon land and structures currently used, or likely to be used for other purposes.

In computing energy consumption related to construction for use and comparison in this analysis, only the

major energy-consuming activities were included. Materials quantities were obtained from the construction cost quantity estimate.

Table 9 summarizes the break-down of the expenditure of construction energy.

2.10 DESIGN CRITERIA

The design criteria presented in Chapter 11.0 of the Supportive Engineering Report of the Final EIS/EIR also applies to the Two-Lane Tunnel Concept. As such, the design of this concept has been developed consistent with these criteria.

Table 9

SUMMARY OF CONSTRUCTION-RELATED ENERGY CONSUMPTION (BTU)

Summary of Facility Useful Lives	No-Build Alternative	Two-Lane Tunnel Concept
* 100 Yr.	0	6.667×10^{10}
** 50 Yr.	2.178×10^{10}	6.643×10^{10}
*** 25 Yr.	1.386×10^{10}	29.72×10^{10}
**** 10 Yr.	0	0.045×10^{10}
TOTAL	3.564×10^{10}	43.07×10^{10}

* Tunnels, Tunnel Excavation, Ventilation Buildings

** Boat Sections, Bridges

*** Bituminous Concrete Pavement, Aggregate Subbase, Drainage Structures, Signing, Guardrail, Earthwork, Railroad Relocations

**** Landscaping

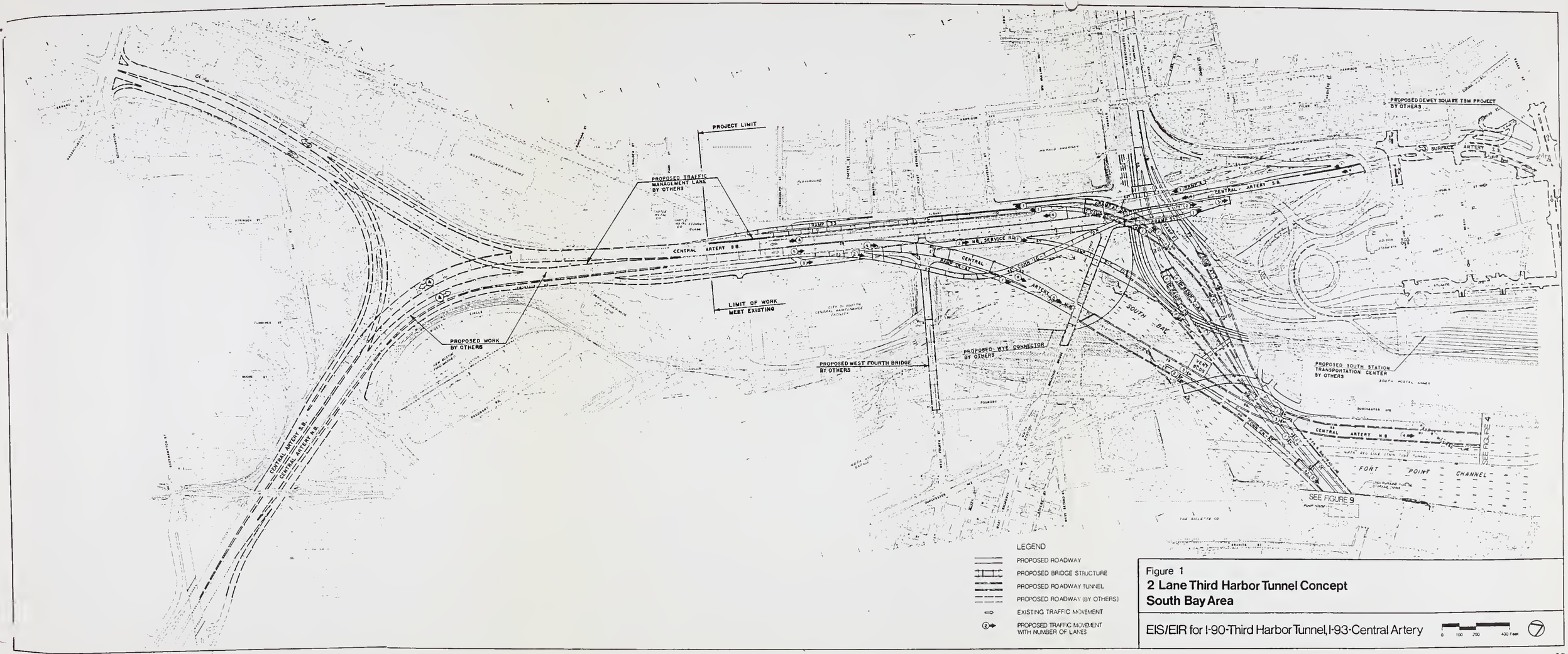


Figure 1
2 Lane Third Harbor Tunnel Concept
South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 400 Feet

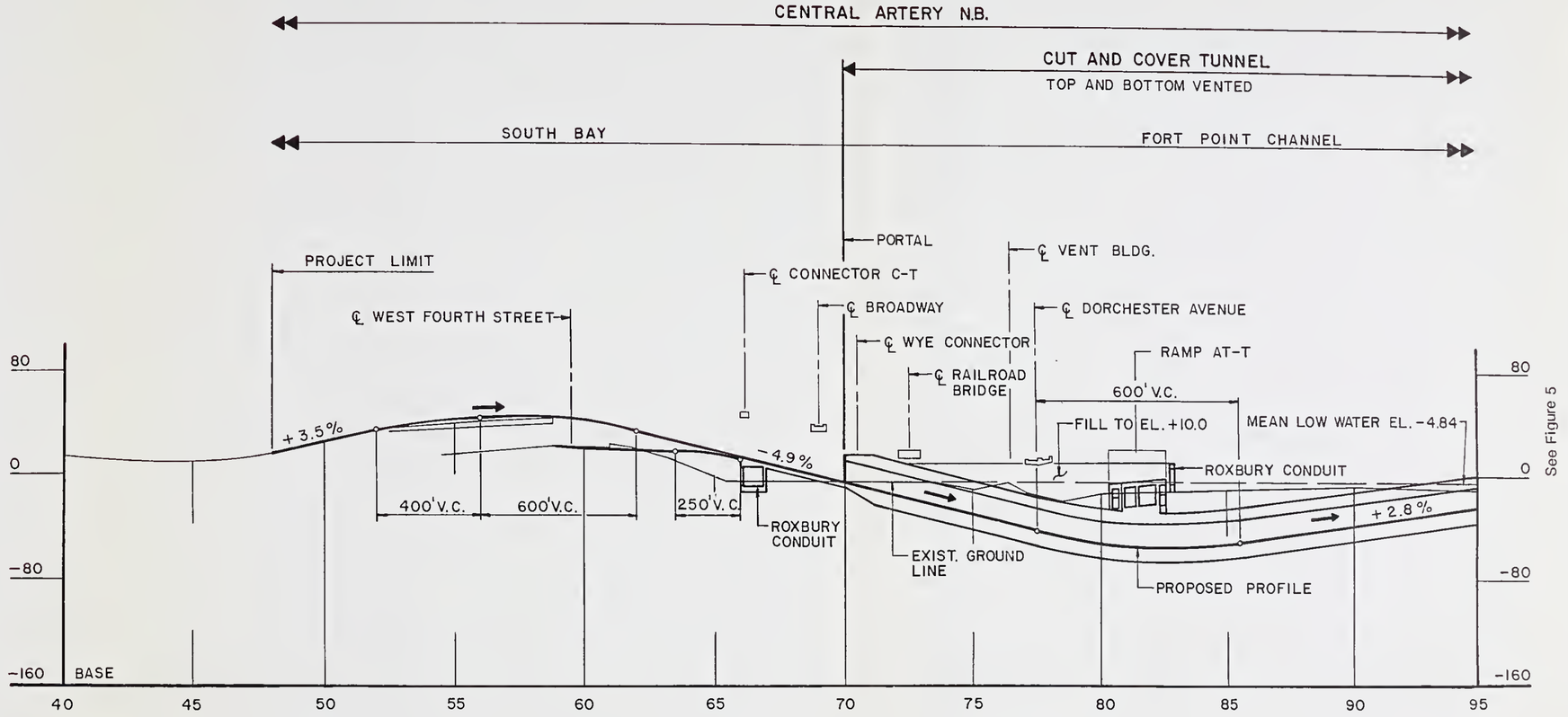


Figure 2
2 Lane Third Harbor Tunnel Concept via South Boston - South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

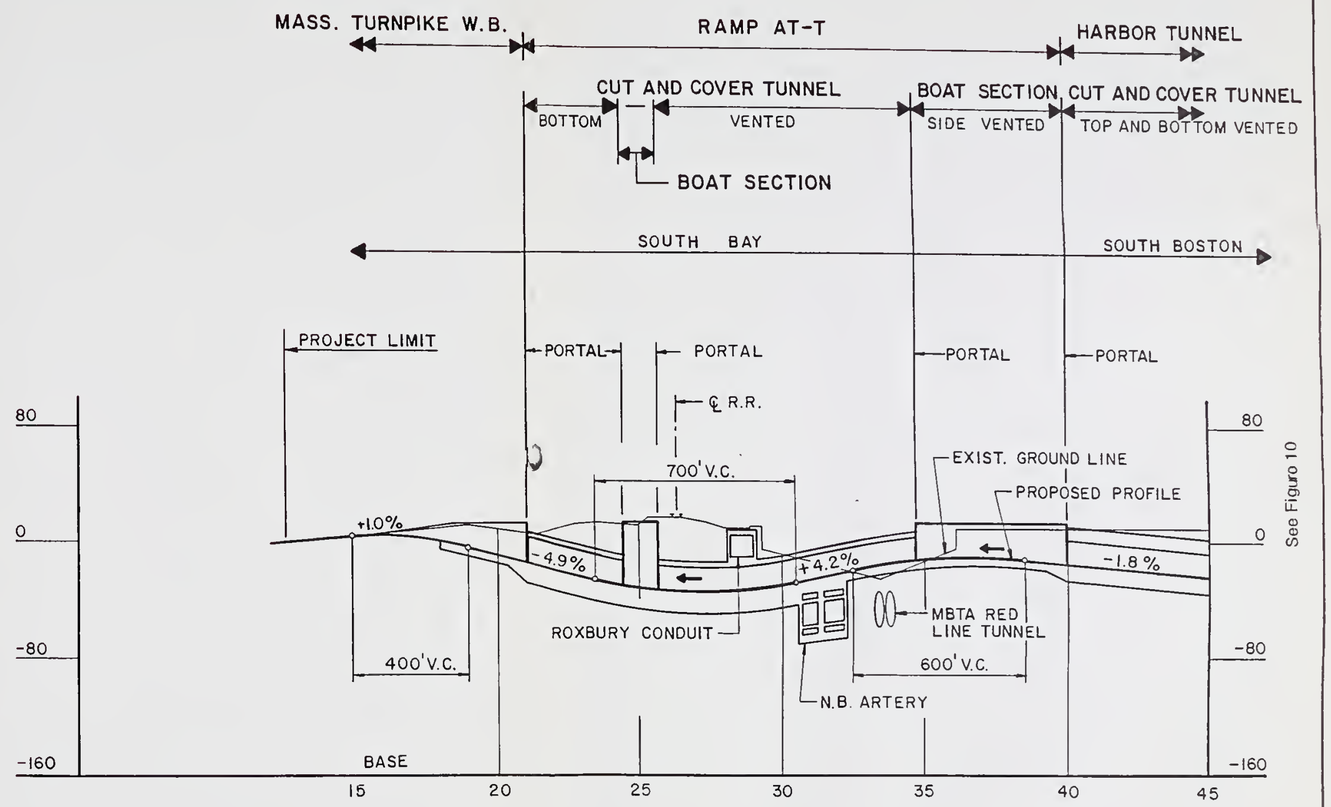


Figure 3
2 Lane Third Harbor Tunnel Concept via South Boston-South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

Figure 4

2 Lane Third Harbor Tunnel Concept
Central Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

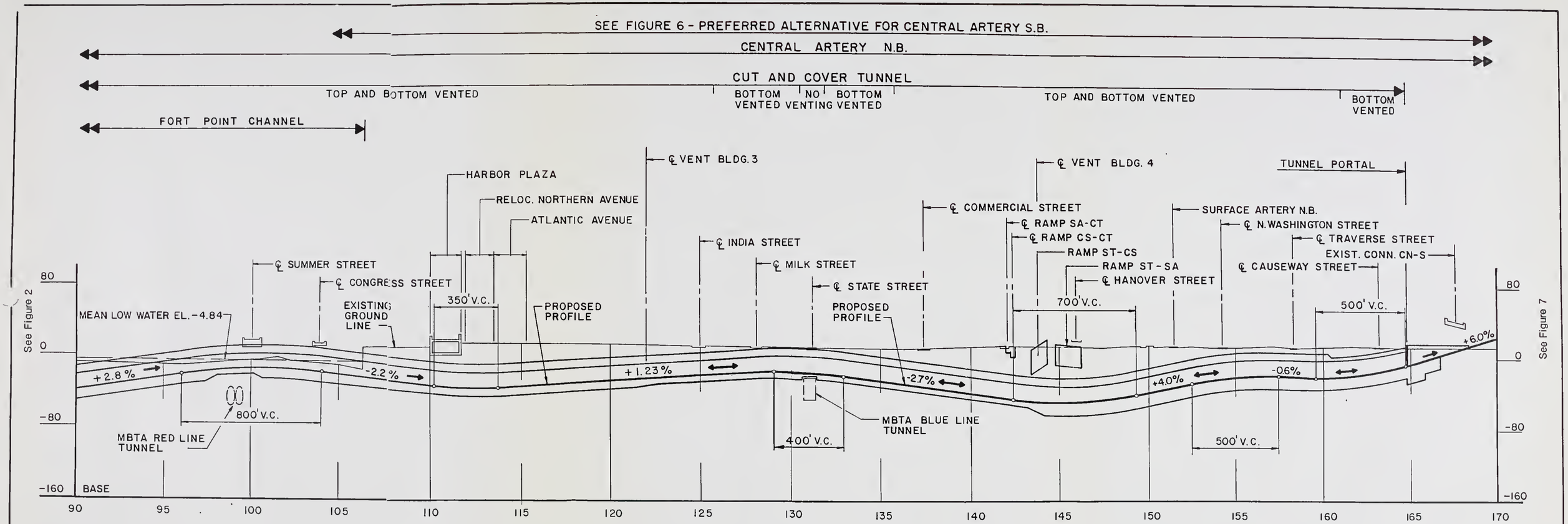


Figure 5
2 Lane Third Harbor Tunnel Concept
Central Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

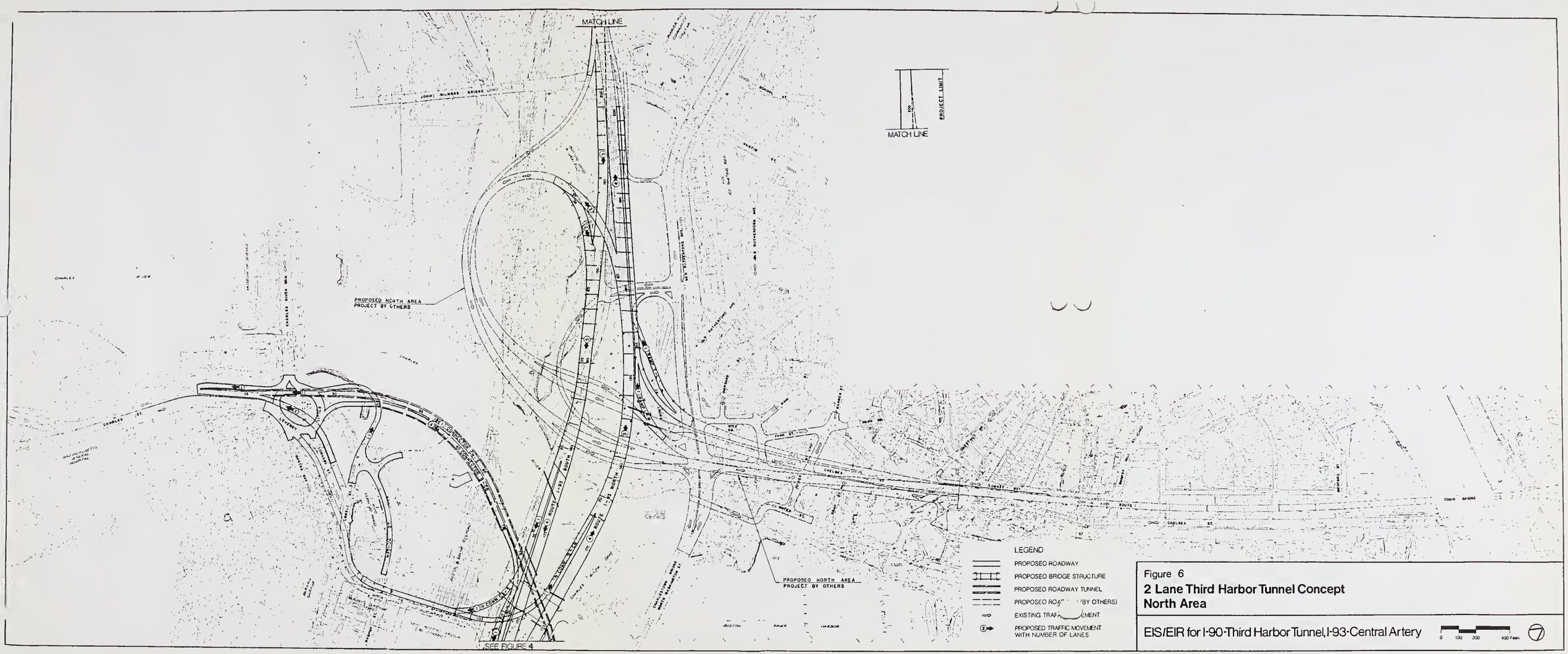


Figure 6
2 Lane Third Harbor Tunnel Concept
North Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 400 Feet

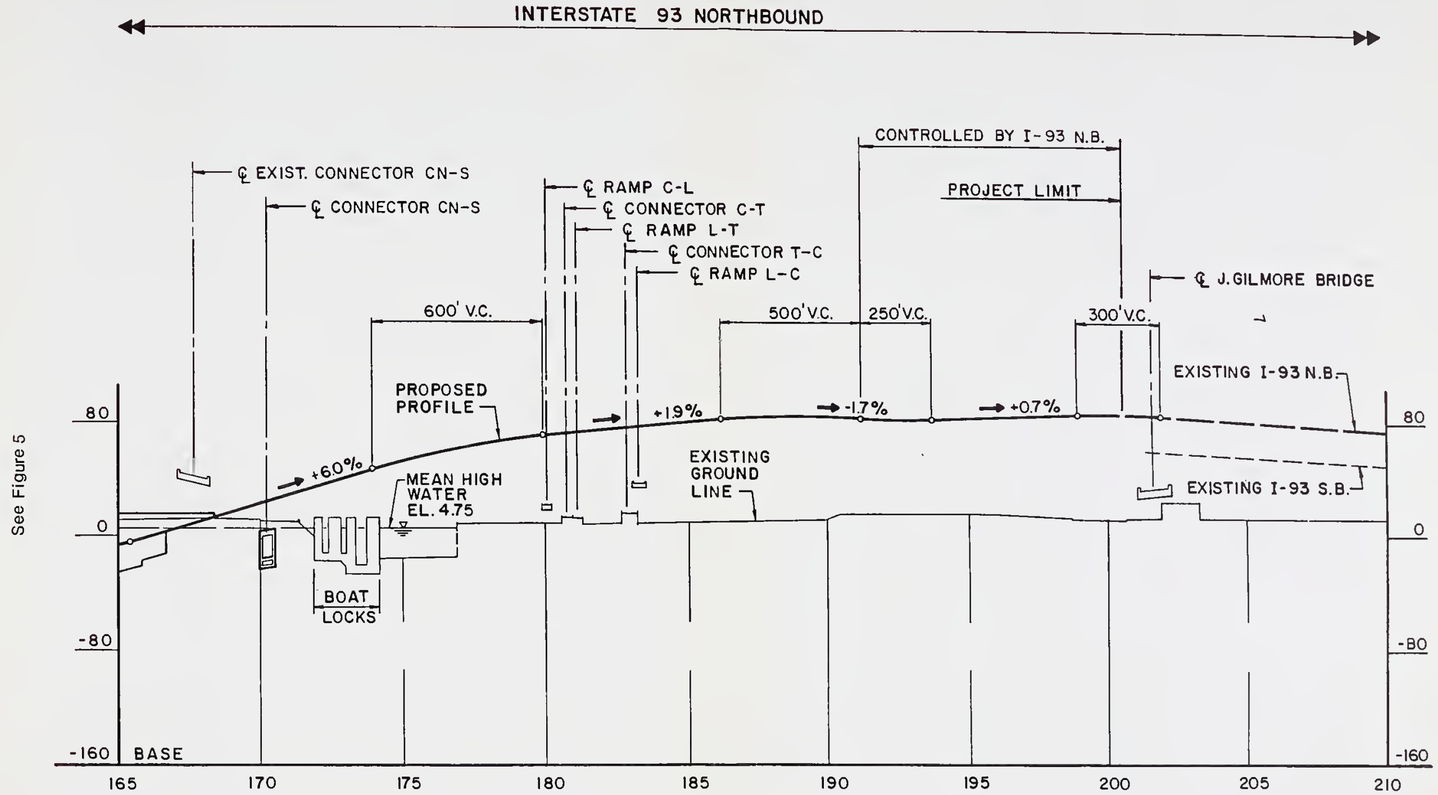


Figure 7
2 Lane Third Harbor Tunnel Concept
North Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

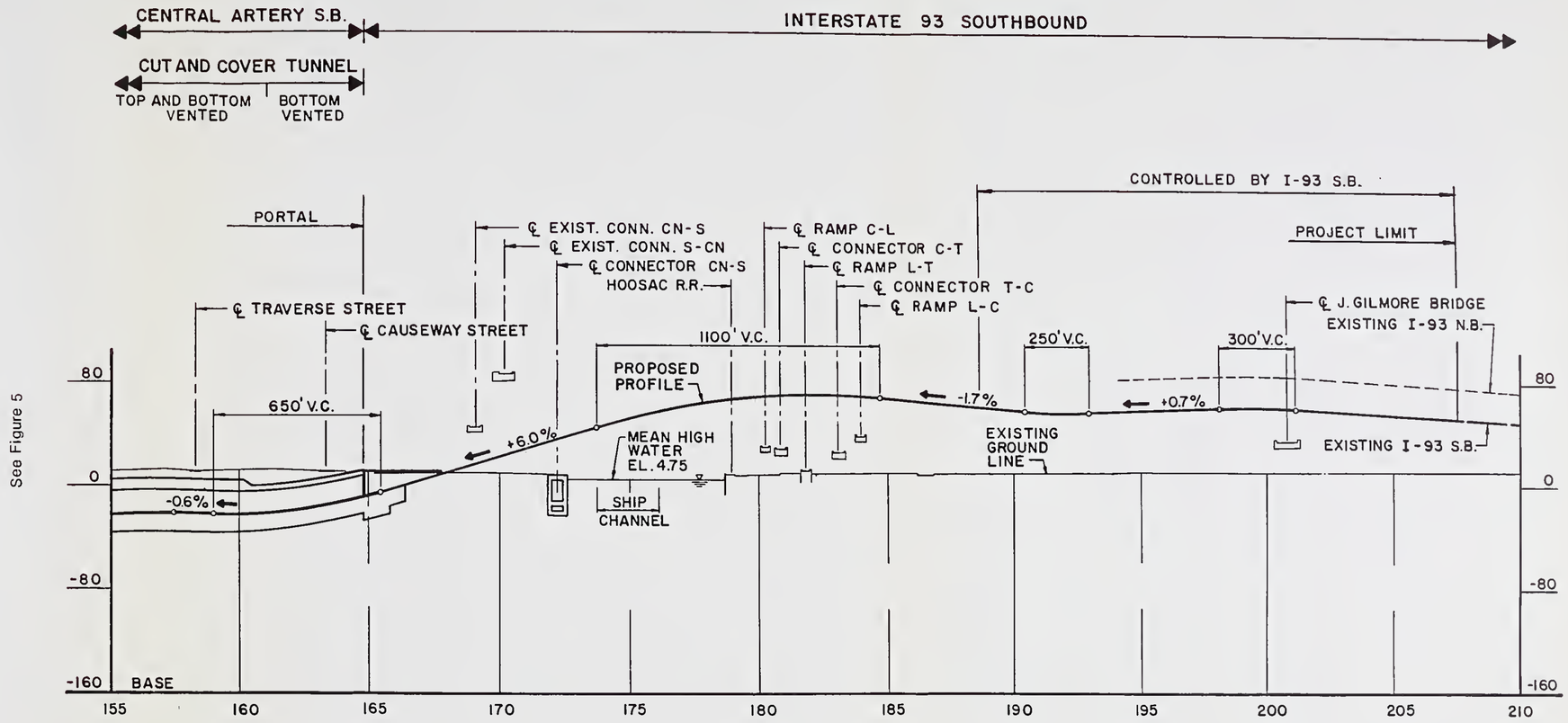


Figure 8
2 Lane Third Harbor Tunnel Concept
North Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

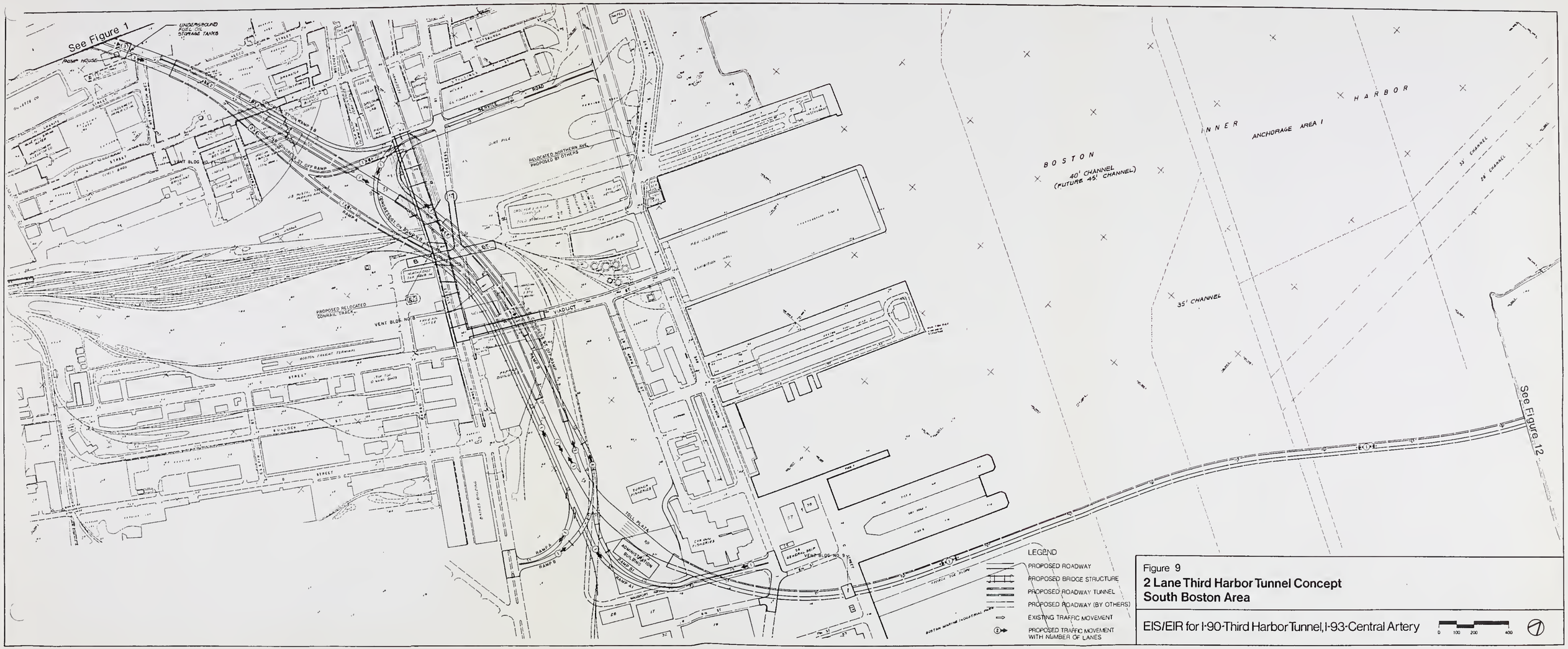


Figure 9
2 Lane Third Harbor Tunnel Concept
South Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

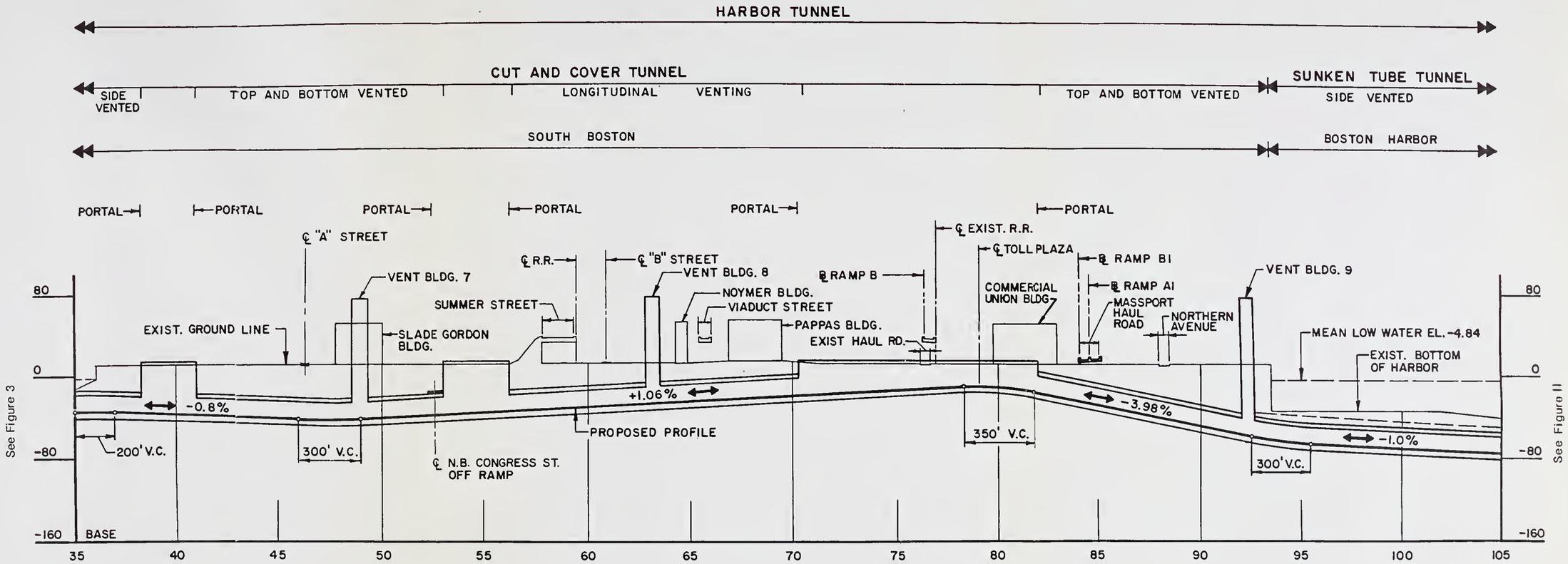


Figure 10
2 Lane Third Harbor Tunnel Concept
South Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

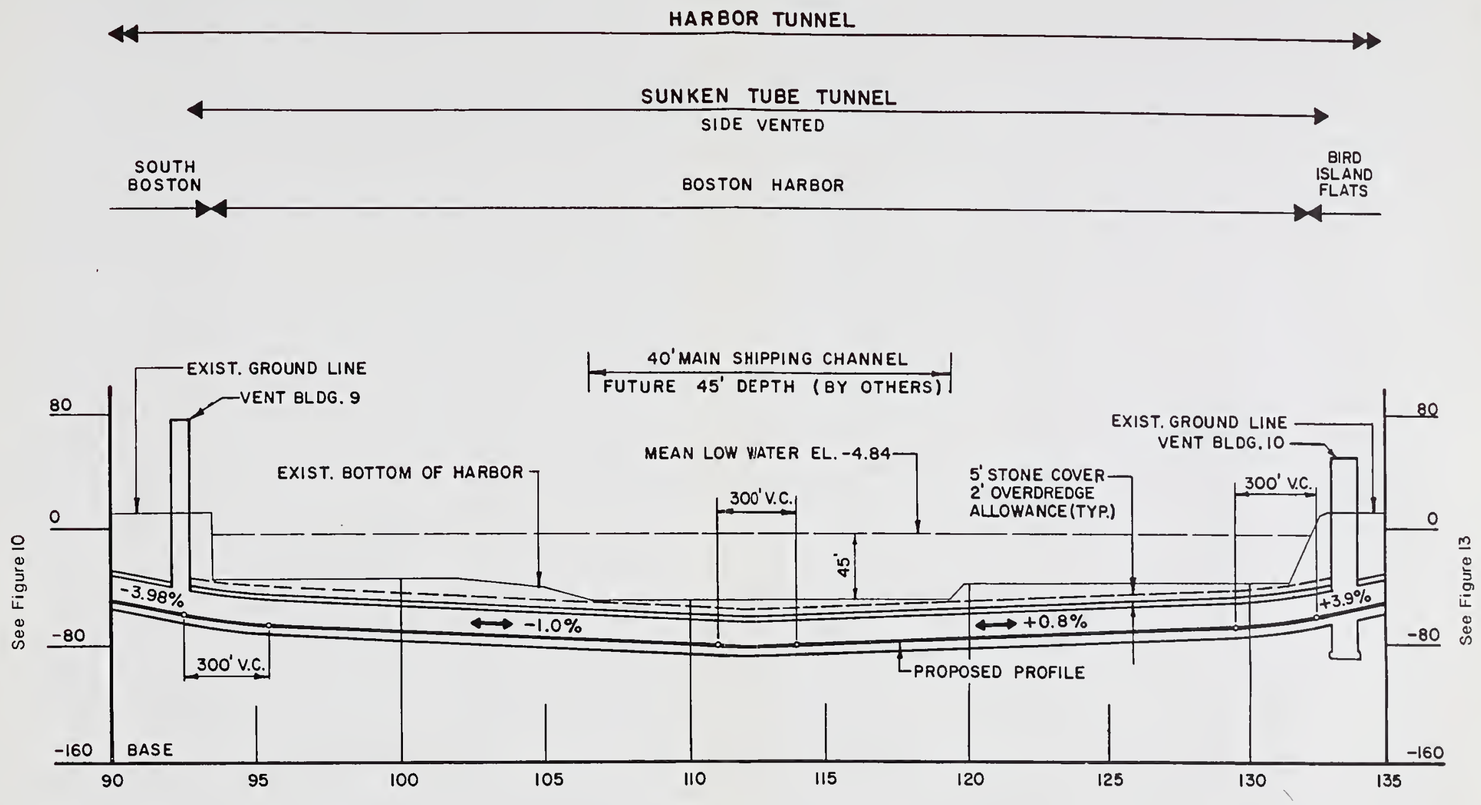


Figure 11

2 Lane Third Harbor Tunnel Concept
South Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

Horizontal Scale 0 200 400 Feet
Vertical Scale 0 40 80

Figure 12
2 Lane Third Harbor Tunnel Concept
East Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

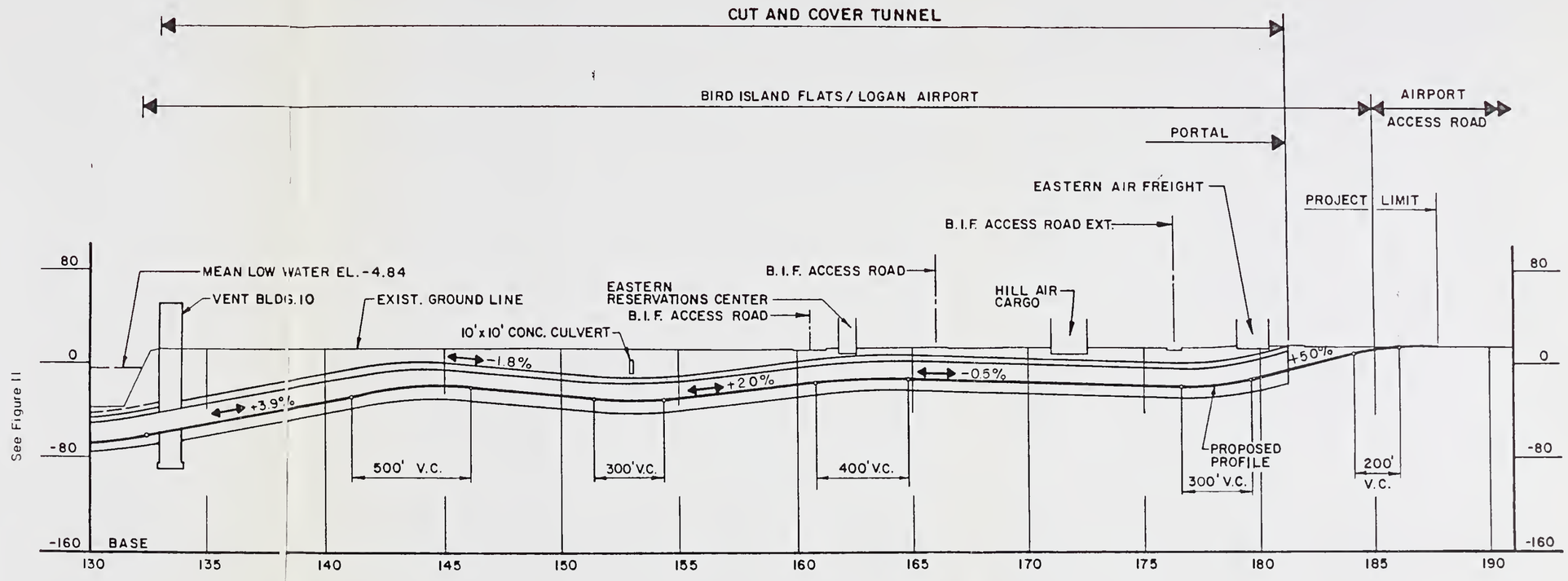
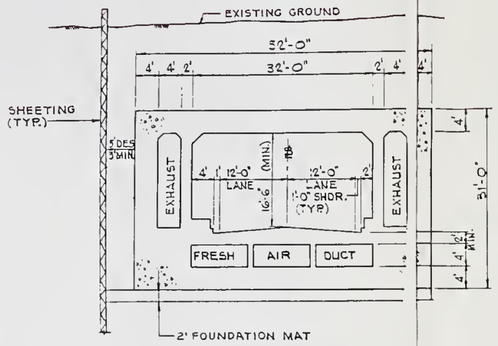
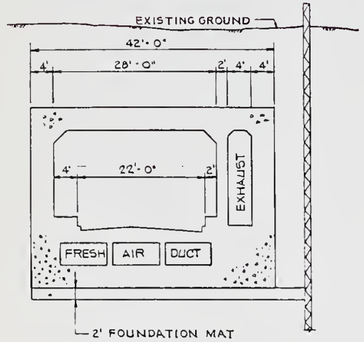


Figure 13
2 Lane Third Harbor Tunnel Concept
East Boston Area

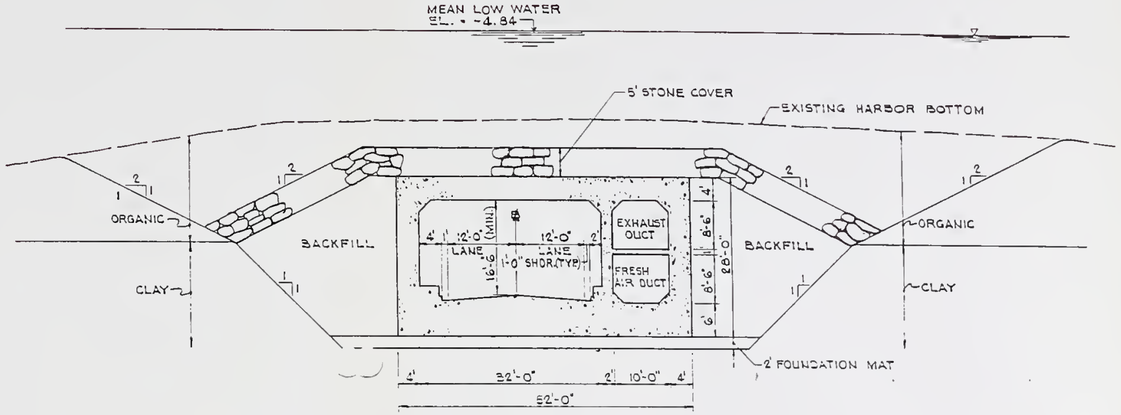
EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery



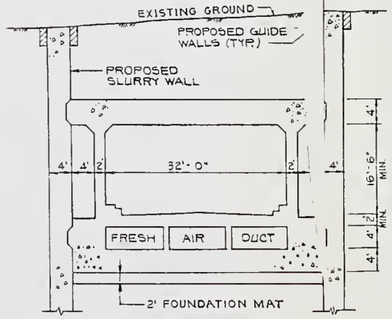
Mainline Tunnel
Sta. 144-00 • Sta. 166-00



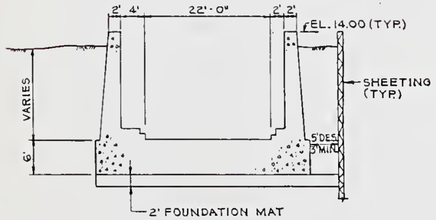
Ramps AP-1 & AP-2
1 Lane Tunnel



2 Lane Sunken Tube Tunnel



Mainline Tunnel
Sta. 133-00 · Sta. 144-00



1 Lane Boat Section

NOTE: FOR OTHER TYPICAL SECTIONS REFER TO FIGURES 176 TO 197 OF THE SUPPORTIVE ENGINEERING REPORT OF THE SDEIS/DEIR (DATED JUNE 1983) AND FIGURES 32 TO 33 OF THE SUPPORTIVE ENGINEERING REPORT OF THE FEIS/EIR (DATED SEPT. 1983)

Figure 14
2 Lane Third Harbor Tunnel Concept - Typical Sections
East Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 5 10 20 Feet

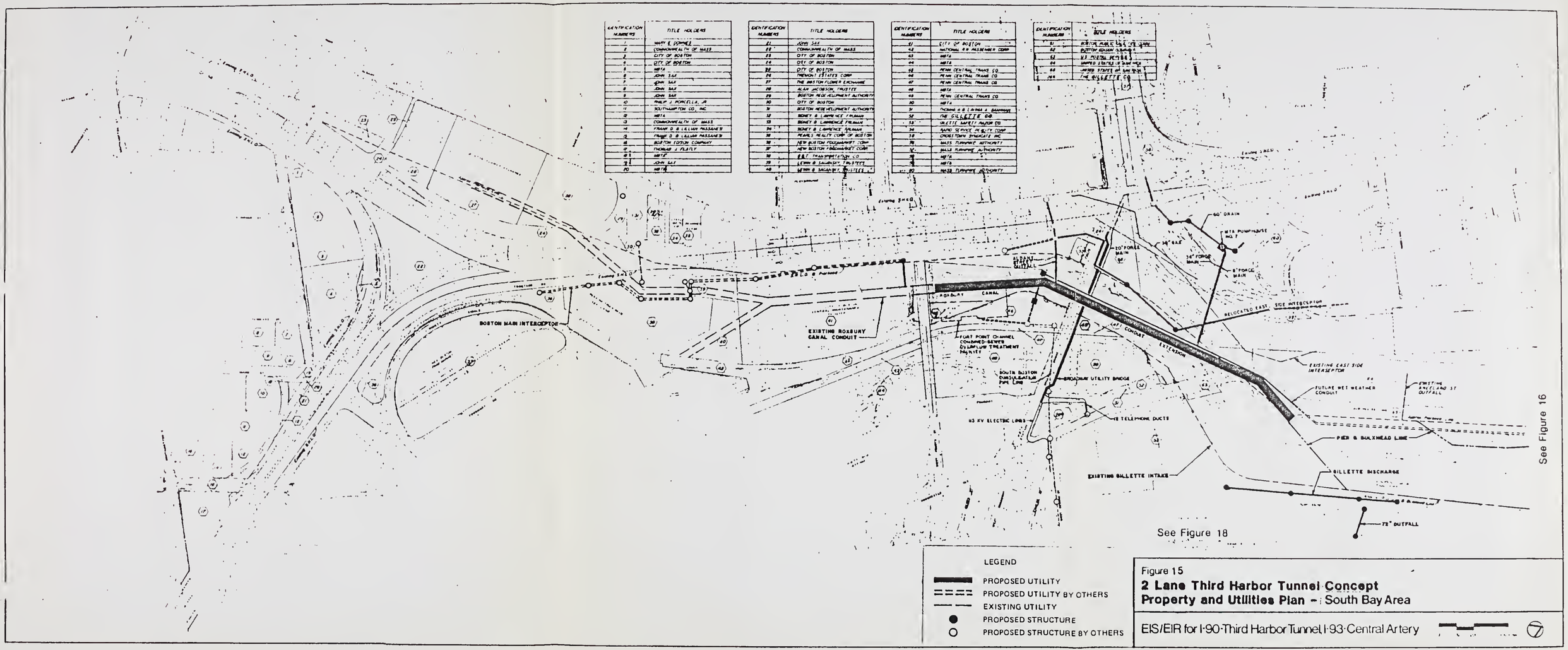
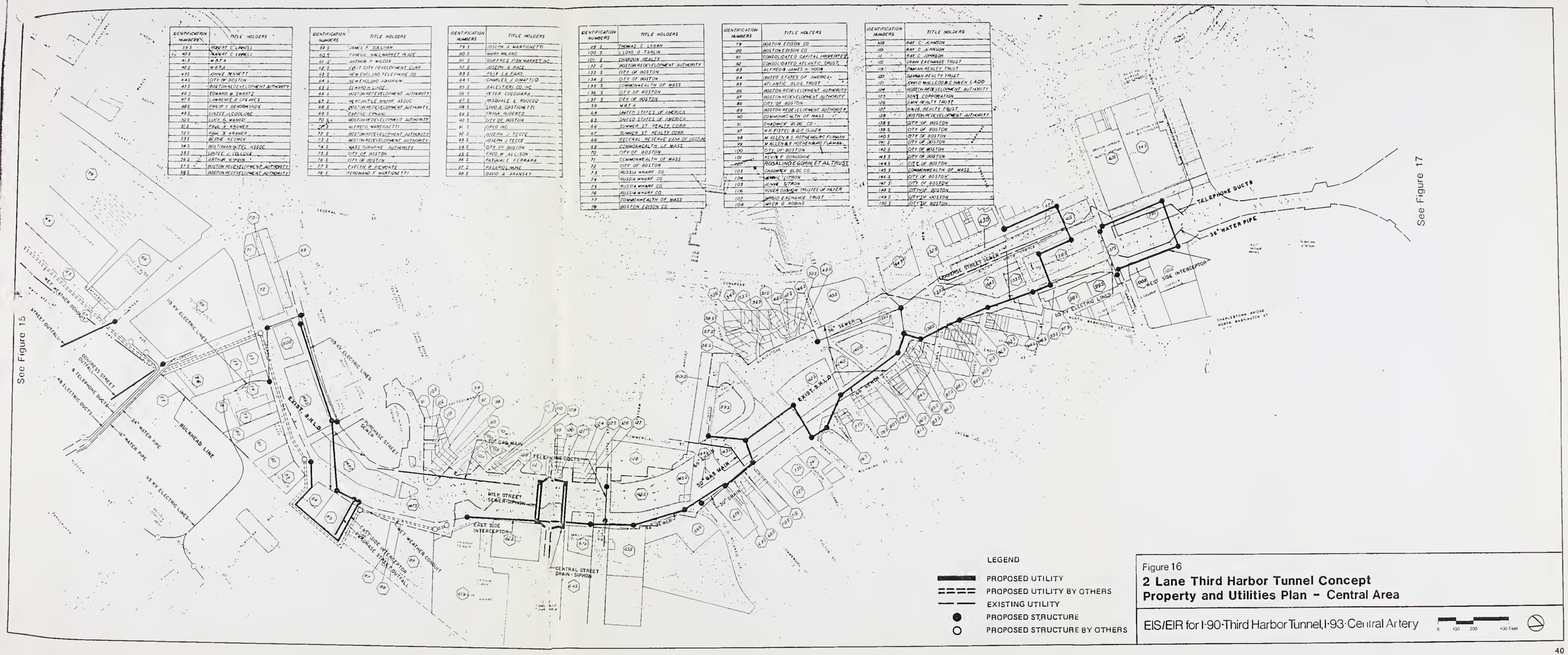


Figure 15
2 Lane Third Harbor Tunnel Concept
Property and Utilities Plan – South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel I-93-Central Artery



IDENTIFICATION NUMBERS	TITLE HOLDERS
39 S	ROBERT C. LOWELL
40 S	ROBERT C. LOWELL
41 S	M.B.T.A.
42 S	M.B.T.A.
43 S	JOHN E. BENNETT
44 S	CITY OF BOSTON
45 S	BOSTON REDEVELOPMENT AUTHORITY
46 S	EDWARD W. SWANTZ
47 S	LAWRENCE D. GREAVES
48 S	PHILIP T. DEVONSHIRE
49 S	LINZEE-LEDOUX INC.
50 S	LUCY G. MANOLI
51 S	PAUL & KRAMER
52 S	PAUL & KRAMER
53 S	BESSIE RESNICK
54 S	BOSTON WHITE STEEL ASSOC.
55 S	LINZEE & COLLOCA
56 S	ARTHUR W. WYNN
57 S	BOSTON REDEVELOPMENT AUTHORITY
58 S	BOSTON REDEVELOPMENT AUTHORITY

IDENTIFICATION NUMBERS	TITLE HOLDERS
59 S	JAMES F. SULLIVAN
60 S	FANEUIL HALL MARKET PLACE
61 S	ARTHUR P. WILCOX
62 S	EAST CITY DEVELOPMENT CORP.
63 S	NEW ENGLAND TELEPHONE CO.
64 S	NEW ENGLAND CONVERTING
65 S	EDWARD A. LINDE
66 S	BOSTON REDEVELOPMENT AUTHORITY
67 S	MERCANTILE WHARF ASSOC.
68 S	BOSTON REDEVELOPMENT AUTHORITY
69 S	CAPITOL COMPANY
70 S	BOSTON REDEVELOPMENT AUTHORITY
71 S	ALFREDO MARTIGNETTI
72 S	BOSTON REDEVELOPMENT AUTHORITY
73 S	BOSTON REDEVELOPMENT AUTHORITY
74 S	MASS. TURNPIKE AUTHORITY
75 S	CITY OF BOSTON
76 S	CITY OF BOSTON
77 S	EVELYN D. DEMONTE
78 S	FERDINAND F. MARTIGNETTI

IDENTIFICATION NUMBERS	TITLE HOLDERS
79 S	JOSEPH A. MARTIGNETTI
80 S	MARY MILANO
81 S	GUFFREE FISH MARKET INC.
82 S	JOSEPH A. PACE
83 S	FELIX LA FAUCI
84 S	CHARLES J. DIMATTEO
85 S	BALESTERI CO. INC.
86 S	PETER CUCCUARO
87 S	MASQUALE L. RUCCO
88 S	LINO A. GASTINETTI
89 S	FRANK HUBERTO
90 S	CITY OF BOSTON
91 S	CIPCO INC.
92 S	JOSEPH J. TECCE
93 S	JOSEPH J. TECCE
94 S	CITY OF BOSTON
95 S	FRED W. ALLISON
96 S	PASQUALE FERRARA
97 S	PASQUALE MONE
98 S	DAVID A. ARANSKY

IDENTIFICATION NUMBERS	TITLE HOLDERS
99 S	THOMAS C. LYNAM
100 S	LLOYD O. TAHLIN
101 S	CHARDON REALTY
102 S	BOSTON REDEVELOPMENT AUTHORITY
103 S	CITY OF BOSTON
104 S	CITY OF BOSTON
105 S	COMMONWEALTH OF MASS.
106 S	CITY OF BOSTON
107 S	CITY OF BOSTON
108 S	COMMONWEALTH OF MASS.
109 S	U.S. GOVERNMENT
110 S	U.S. GOVERNMENT
111 S	U.S. GOVERNMENT
112 S	U.S. GOVERNMENT
113 S	U.S. GOVERNMENT
114 S	U.S. GOVERNMENT
115 S	U.S. GOVERNMENT
116 S	U.S. GOVERNMENT
117 S	U.S. GOVERNMENT
118 S	U.S. GOVERNMENT
119 S	U.S. GOVERNMENT
120 S	U.S. GOVERNMENT
121 S	U.S. GOVERNMENT
122 S	U.S. GOVERNMENT
123 S	U.S. GOVERNMENT
124 S	U.S. GOVERNMENT
125 S	U.S. GOVERNMENT
126 S	U.S. GOVERNMENT
127 S	U.S. GOVERNMENT
128 S	U.S. GOVERNMENT
129 S	U.S. GOVERNMENT
130 S	U.S. GOVERNMENT
131 S	U.S. GOVERNMENT
132 S	U.S. GOVERNMENT
133 S	U.S. GOVERNMENT
134 S	U.S. GOVERNMENT
135 S	U.S. GOVERNMENT
136 S	U.S. GOVERNMENT
137 S	U.S. GOVERNMENT
138 S	U.S. GOVERNMENT
139 S	U.S. GOVERNMENT
140 S	U.S. GOVERNMENT
141 S	U.S. GOVERNMENT
142 S	U.S. GOVERNMENT
143 S	U.S. GOVERNMENT
144 S	U.S. GOVERNMENT
145 S	U.S. GOVERNMENT
146 S	U.S. GOVERNMENT
147 S	U.S. GOVERNMENT
148 S	U.S. GOVERNMENT
149 S	U.S. GOVERNMENT
150 S	U.S. GOVERNMENT

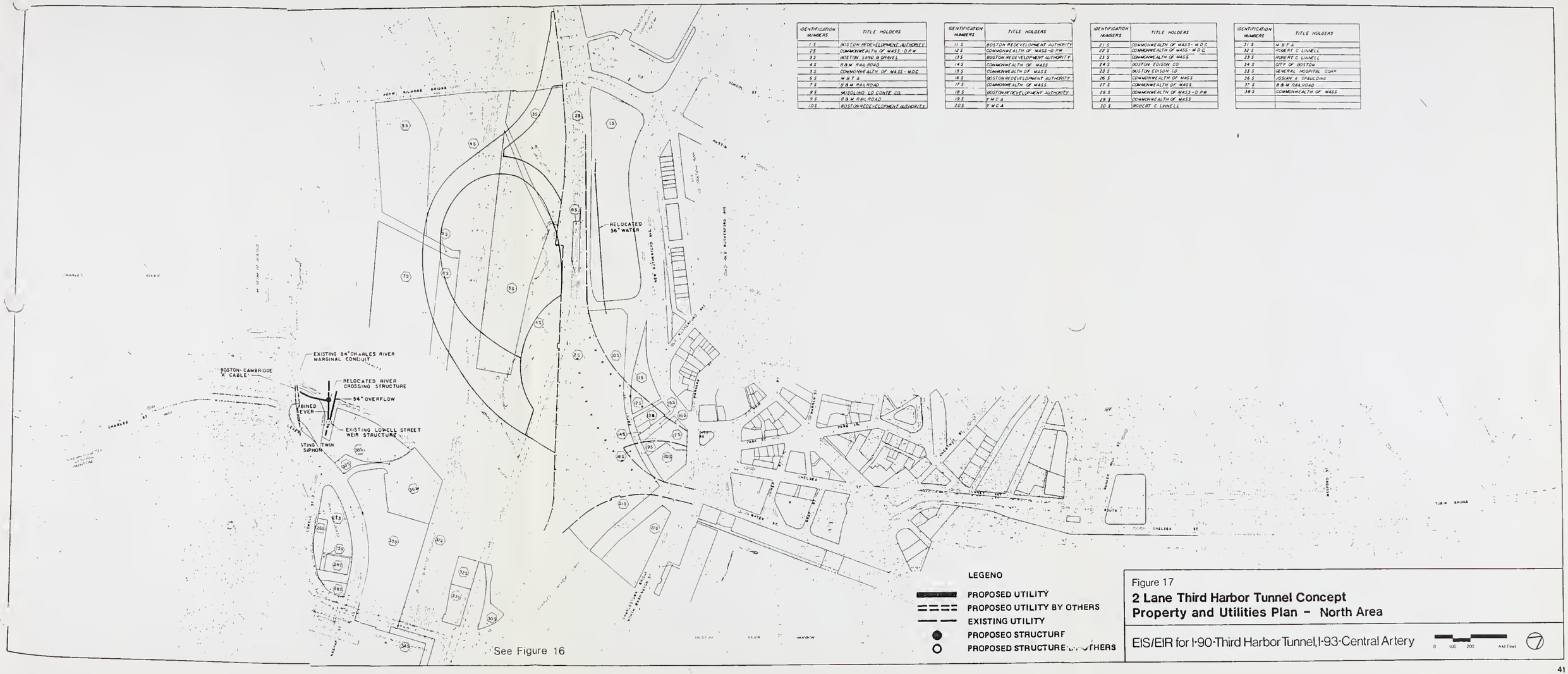
IDENTIFICATION NUMBERS	TITLE HOLDERS
78	BOSTON EDISON CO.
79	BOSTON EDISON CO.
80	BOSTON EDISON CO.
81	CONSOLIDATED CAPITAL PROPERTIES
82	CONSOLIDATED ATLANTIC TRUST
83	ALFRED & JAMES H. HOOD
84	UNITED STATES OF AMERICA
85	ATLANTIC BLDG. TRUST
86	BOSTON REDEVELOPMENT AUTHORITY
87	BOSTON REDEVELOPMENT AUTHORITY
88	CITY OF BOSTON
89	BOSTON REDEVELOPMENT AUTHORITY
90	COMMONWEALTH OF MASS.
91	CHADWICK BLDG. CO.
97	H.R. FISTEL & D.F. FISHER
98	W. ALLEN & S. ROTHENBURG FURMAN
99	W. ALLEN & S. ROTHENBURG FURMAN
100	CITY OF BOSTON
101	KEVIN F. DONOGHUE
102	ROSALINDE GORIN, ET AL TRUST
103	CHADWICK BLDG. CO.
104	GENE STRON
105	GENE STRON
106	ROGER DASHOW TRUSTEE OF HEIFER
107	BROAD EXCHANGE TRUST
108	MYER D. ROBINS

IDENTIFICATION NUMBERS	TITLE HOLDERS
109	RAY C. JOHNSON
110	RAY C. JOHNSON
111	RAY C. JOHNSON
112	GRAY EXCHANGE TRUST
113	DAMIAN REALTY TRUST
120	DAMIAN REALTY TRUST
121	JOHN D. MACLEOD & C. HAVEN LADD
124	BOSTON REDEVELOPMENT AUTHORITY
125	SONY CORPORATION
126	SHIN REALTY TRUST
127	NAGA REALTY TRUST
128	BOSTON REDEVELOPMENT AUTHORITY
138 S	CITY OF BOSTON
139 S	CITY OF BOSTON
140 S	CITY OF BOSTON
141 S	CITY OF BOSTON
142 S	CITY OF BOSTON
143 S	CITY OF BOSTON
144 S	CITY OF BOSTON
145 S	COMMONWEALTH OF MASS.
146 S	CITY OF BOSTON
147 S	CITY OF BOSTON
148 S	CITY OF BOSTON
149 S	CITY OF BOSTON
150 S	CITY OF BOSTON

Figure 16

2 Lane Third Harbor Tunnel Concept Property and Utilities Plan - Central Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery



IDENTIFICATION NUMBERS	TITLE HOLDERS
1 S	BOSTON REDEVELOPMENT AUTHORITY
2 S	COMMONWEALTH OF MASS - D P W
3 S	BOSTON SAND & GRAVEL
4 S	B & M RAILROAD
5 S	COMMONWEALTH OF MASS - MDC
6 S	M B T A
7 S	B & M RAILROAD
8 S	MUSOLINO LO CONTE CO.
9 S	B & M RAILROAD
10 S	BOSTON REDEVELOPMENT AUTHORITY

IDENTIFICATION NUMBERS	TITLE HOLDERS
11 S	BOSTON REDEVELOPMENT AUTHORITY
12 S	COMMONWEALTH OF MASS - D P W
13 S	BOSTON REDEVELOPMENT AUTHORITY
14 S	COMMONWEALTH OF MASS
15 S	COMMONWEALTH OF MASS
16 S	BOSTON REDEVELOPMENT AUTHORITY
17 S	COMMONWEALTH OF MASS
18 S	BOSTON REDEVELOPMENT AUTHORITY
19 S	Y M C A
20 S	Y M C A

IDENTIFICATION NUMBERS	TITLE HOLDERS
21 S	COMMONWEALTH OF MASS - M D C
22 S	COMMONWEALTH OF MASS - M D C
23 S	COMMONWEALTH OF MASS
24 S	BOSTON EDISON CO.
25 S	BOSTON EDISON CO.
26 S	COMMONWEALTH OF MASS
27 S	COMMONWEALTH OF MASS
28 S	COMMONWEALTH OF MASS - D P W
29 S	COMMONWEALTH OF MASS
30 S	ROBERT C. LINNELL

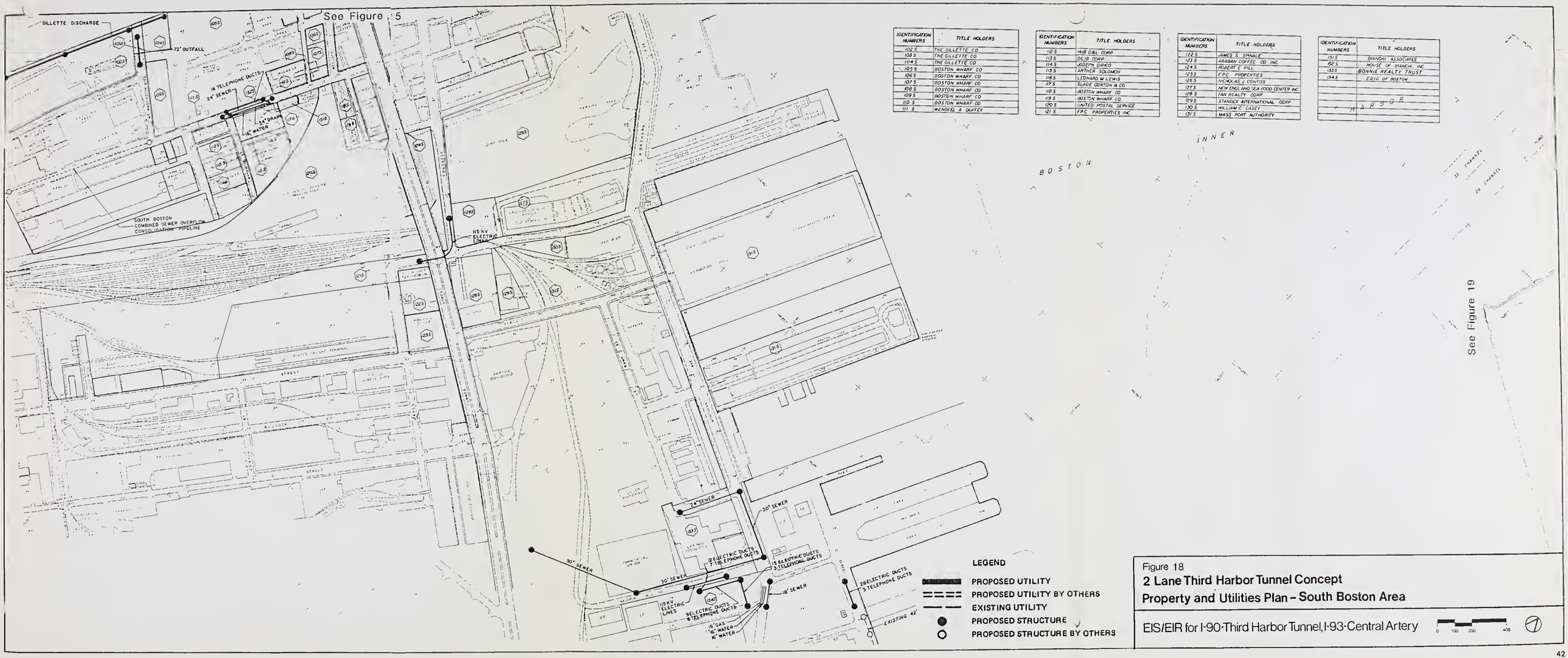
IDENTIFICATION NUMBERS	TITLE HOLDERS
31 S	M B T A
32 S	ROBERT C. LINNELL
33 S	ROBERT C. LINNELL
34 S	CITY OF BOSTON
35 S	GENERAL HOSPITAL CORP
36 S	JOSIAH A. SPAULDING
37 S	B & M RAILROAD
38 S	COMMONWEALTH OF MASS

Figure 17

2 Lane Third Harbor Tunnel Concept
Property and Utilities Plan - North Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 Feet



IDENTIFICATION NUMBERS	TITLE HOLDERS
102 S	THE GILLETTE CO
103 S	THE GILLETTE CO
104 S	THE GILLETTE CO
105 S	BOSTON WHARF CO
106 S	BOSTON WHARF CO
107 S	BOSTON WHARF CO
108 S	BOSTON WHARF CO
109 S	BOSTON WHARF CO
110 S	BOSTON WHARF CO
111 S	WENDED & DUFFEY

IDENTIFICATION NUMBERS	TITLE HOLDERS
112 S	HUB OIL CORP
113 S	OILIB CORP
114 S	JOSEPH DIRICO
115 S	ARTHER SOLOMON
116 S	LEONARD M LEWIS
117 S	SLADE GORTON & CO
118 S	BOSTON WHARF CO
119 S	BOSTON WHARF CO
120 S	UNITED POSTAL SERVICE
121 S	F.P.C. PROPERTIES INC.

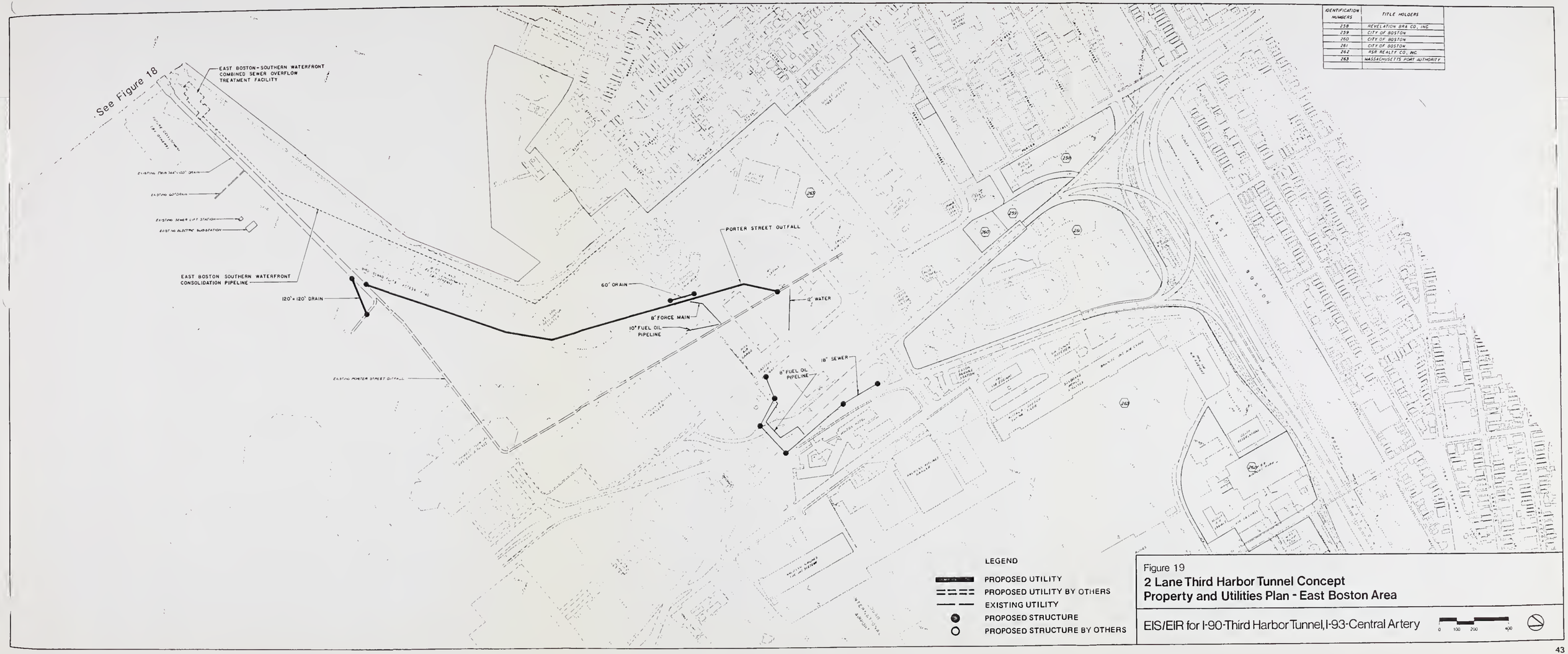
IDENTIFICATION NUMBERS	TITLE HOLDERS
122 S	JAMES S SIMNALE
123 S	ARABAN COFFEE CO INC.
124 S	ROBERT E PILL
125 S	F.P.C. PROPERTIES
126 S	NICHOLAS J CONTOS
127 S	NEW ENGLAND SEA FOOD CENTER INC.
128 S	FAN REALTY CORP
129 S	STANDEX INTERNATIONAL CORP
130 S	WILLIAM C CASEY
131 S	MASS PORT AUTHORITY

IDENTIFICATION NUMBERS	TITLE HOLDERS
151 S	BIANCHI ASSOCIATES
152 S	HOUSE OF BIANCHI INC.
153 S	BONNIE REALTY TRUST
154 S	EDIC OF BOSTON

Figure 18
2 Lane Third Harbor Tunnel Concept
Property and Utilities Plan – South Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 400



IDENTIFICATION NUMBERS	TITLE HOLDERS
258	REVELATION BRA CO., INC.
259	CITY OF BOSTON
260	CITY OF BOSTON
261	CITY OF BOSTON
262	RSR REALTY CO., INC.
263	MASSACHUSETTS PORT AUTHORITY

Figure 19
2 Lane Third Harbor Tunnel Concept
Property and Utilities Plan - East Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

SEQUENCE NO. 1

YEAR	1												2											
MONTH	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1. Construct Temporary Satellite for Eastern Terminal.																								
2. Begin Mainline Cut and Cover Tunnel Construction.																								
3. Construct Ventilation Building.																								
4. Construct Temporary Airport Access Road.																								
5. Construct Portion of Ramp AP-2.																								

NOTES:

FOR STAGE CONSTRUCTION PLANS OF THE SOUTH BAY, CENTRAL AND NORTH AREAS, SEE FIGURES 226 TO 234 AND 253 TO 263 IN THE SUPPORTIVE ENGINEERING REPORT OF SDEIS/DEIR (DATED JUNE 1983).

FOR THE SOUTH BOSTON AREA, SEE FIGURES 65 TO 67 OF THE SUPPORTIVE ENGINEERING REPORT OF THE FEIS/EIR (DATED SEPTEMBER 1933).

LEGEND

- CONSTRUCTION PERFORMED DURING THIS PHASE
- ROADWAYS IN SERVICE
- ROADWAYS REMOVED

Figure 20

2 Lane Third Harbor Tunnel Concept–Stage Construction East Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 400

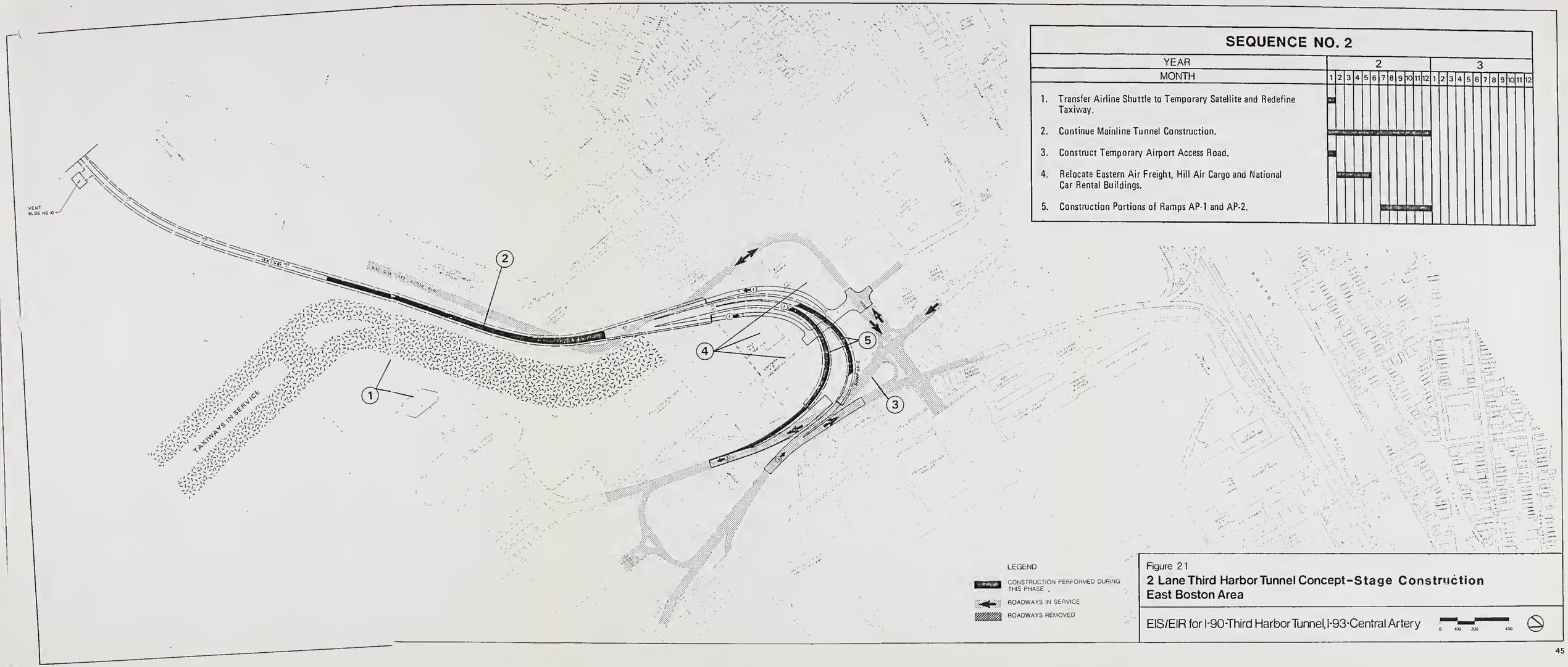


Figure 21
2 Lane Third Harbor Tunnel Concept–Stage Construction East Boston Area

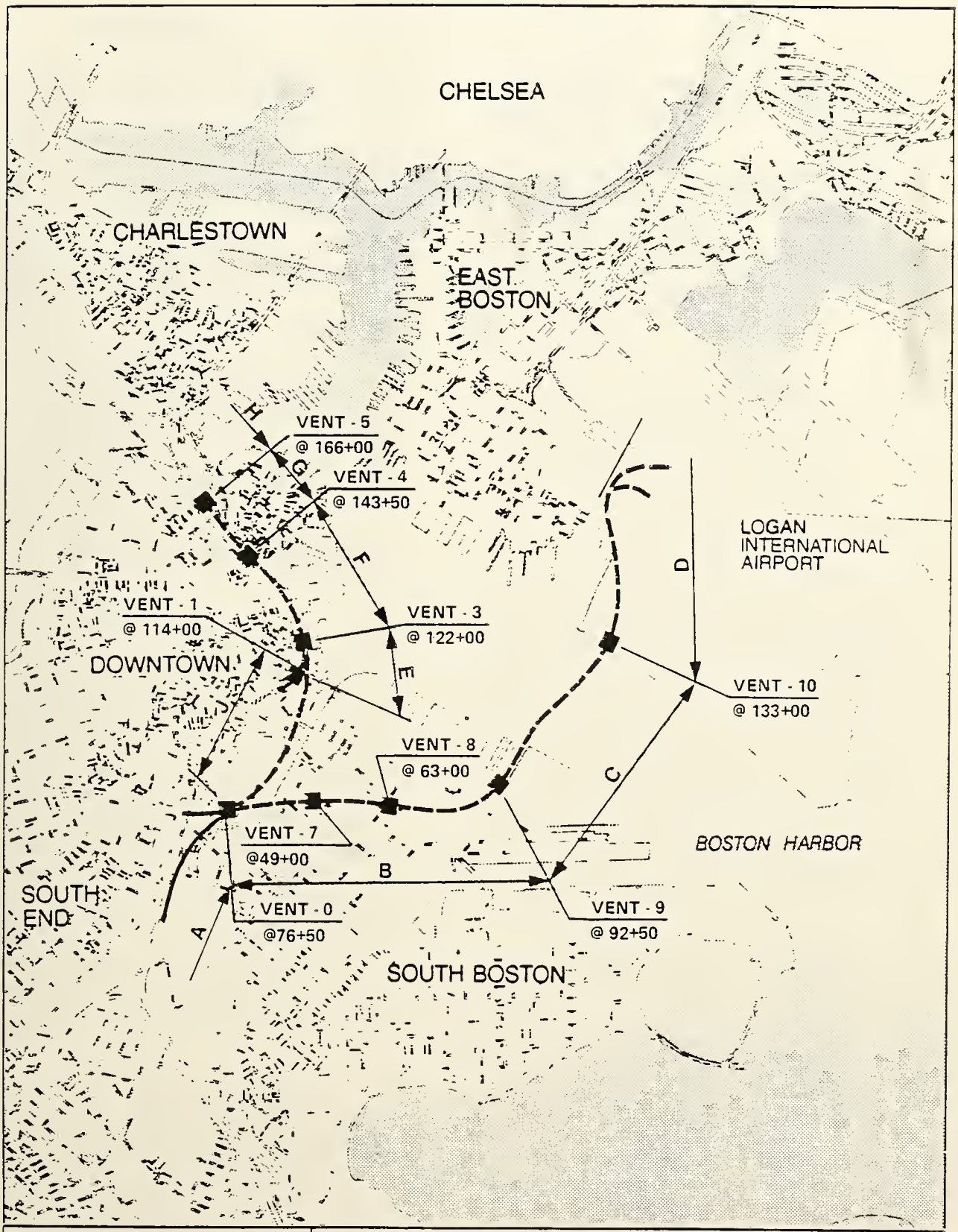
EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

SEQUENCE NO. 3

YEAR	2												3											
MONTH	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1. Relocate Taxiway to Original Location.																								
2. Transfer Eastern Shuttle to Original Satellite and Remove Temporary Satellite.																								
3. Construct Temporary B.I.F. Access Road.																								
4. Complete Mainline Tunnel Construction.																								
5. Repair Airport Access Road and Remove Temporary Road.																								
6. Construct Ramps to and from Bird Island Flats.																								

Figure 22
2 Lane Third Harbor Tunnel Concept–Stage Construction
East Boston Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery



Vent Building

A Duct Segment

Tunnel

New Roadway—at grade or elevated

Figure 23

2 Lane Third Harbor Tunnel Concept

Building and Duct Segment Location

0 800 1600 3200 Feet

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

3.0 ENVIRONMENTAL CONSEQUENCES

3.1 TRANSPORTATION

This section examines in detail year 1990 and 2010 transportation impacts of the Two-Lane Tunnel Concept, as compared to the No-Build Alternative. The reader is referenced to Section 3.1 of the FEIS/FEIR for detailed information on existing and future No-Build Alternative traffic conditions. Impacts have been analyzed under the following categories:

- Traffic Volumes
- Volume-to-Capacity Ratios and Levels of Service
- Central Artery Bottlenecks and Congestion Points
- Vehicle Miles, Vehicle Hours, and Person Hours of Travel
- Safety
- Other Transportation Facilities
- Construction Impacts

The long-term (1990 and 2010) impacts of the No-Build Alternative with a redecked Central Artery, are identical to those of a Do-Nothing alternative, because redecking must be undertaken if the Central Artery remains in its current alignment. Since redecking is required under the No-Build Alternative, both the Two-Lane Tunnel Concept and the No-Build Alternative have significant construction impacts which are discussed below.

The Two-Lane Tunnel Concept assumes a two-way toll facility. While this is inconsistent with the one-way inbound toll system which now exists for the Mystic-Tobin Bridge and Callahan/Sumner Tunnels, studies of the results of one-way toll operation indicate that shifts in traffic patterns are not significant (6 percent or less). Therefore, the results of the analysis that follows would generally apply to a one-way (inbound) toll system as well.

3.1.1 Summary

Overview Comparison of the Two-Lane Tunnel Concept vs. the Preferred Alternative

Generally, implementation of the Preferred Alternative will result in more substantial overall traffic improvements than would occur under the Two-Lane Tunnel Concept. Following is a discussion of the principal differences between the two alternatives.

On the regional highway network, the Two-Lane Tunnel Concept significantly reduces the number of hours of congested operation on a typical weekday in 2010 from the 5 to 14 hours per day found under the No-Build Alternative to 1 to 5 hours per day. With the Preferred Alternative, the range of congested hours is reduced further, to 1 to 2 hours per day. Because of the reduced cross harbor capacity of the Two-Lane Tunnel Concept, queues on the Central Artery are not as short as with the Preferred Alternative. In several instances, queues are longer than with the No-Build Alternative. Peak hour LOS's on the regional network in 2010 are generally expected to be improved with the Two-Lane Tunnel Concept relative to the No-Build Alternative, but not as significantly improved as with the Preferred Alterative.

In East Boston, the Two-Lane Tunnel Concept is not as effective at reducing traffic congestion on local streets as the Preferred Alternative. Short-cutting to escape Route 1A congestion approaching the Sumner Tunnel would continue with the Two-Lane Tunnel Concept. Under the Preferred Alternative, traffic approaching the Sumner Tunnel is spl between the Sumner Tunnel and the Third Harbor Tunnel southbound, thus eliminating a significant amount of congestion and short-cutting to local East Boston streets. The Two-Lane Tunnel Concept would result in 69 percent LOS A-D locations (the same as the No-Build Alternative) versus 77 percent LOS A-D locations with the

Preferred Alternative during the 2010 AM peak hour. During the 2010 PM peak hour, the Two-Lane Tunnel Concept is nearly as effective as the Preferred Alternative in the number of LOS A-D locations (75 percent vs. 77 percent with the Preferred Alternative). The No-Build Alternative results in only 62 percent of the intersections operating at LOS A-D.

In South Boston, the Two-Lane Tunnel Concept in 2010 removes 27 percent fewer trucks and short-cutting traffic from local streets than does the Preferred Alternative. Relative to the No-Build Alternative, however, truck traffic on local streets is reduced somewhat as a result of the Seaport Access Tunnel's interchanges with Northern Avenue and Summer Street. Traffic volumes with the Two-Lane Tunnel Concept on the Third Harbor Tunnel interchange at Congress Street, Northern Avenue, and Summer Streets are higher than with the Preferred Alternative because traffic destined for downtown Boston would try to avoid increased congestion on the Central Artery. Unlike the Preferred Alternative, the Two-Lane Tunnel Concept (as presently designed) does not feature either a relocated Dorchester Avenue or a substantially improved South Bay interchange between I-90 and the Southeast Expressway/Central Artery/South Station Transportation Center. With the Preferred Alternative, these design features will serve to keep much of the downtown-oriented traffic out of the northern industrial area of South Boston. This will in turn allow the South Boston interchanges to operate at acceptable levels of service. During the 2010 AM peak hour, the Two-Lane Tunnel Concept would result in 47 percent LOS A-D locations, while the Preferred Alternative would result in 55 percent LOS A-D at locations analyzed, compared to 26 percent LOS A-D locations with the No-Build Alternative. In the 2010 PM peak hour, the Two-Lane Tunnel Concept would result in 47 percent LOS A-D locations (the same as with the No-Build Alternative), while the Preferred Alternative would result in 60 percent LOS A-D locations.

In downtown Boston during the 2010 AM peak hour, the Two-Lane Tunnel Concept results in 54 percent LOS A-D locations against 40 percent LOS A-D locations for the No-Build Alternative. The Preferred Alternative would result in 64 percent LOS A-D locations. During the 2010 PM peak hour, the Two-Lane Tunnel Concept would result in 48 percent of the locations operating at LOS A-D, while only 25 percent would operate that well with the No-Build Alternative. The Preferred Alternative would result in 68 percent LOS A-D locations.

In 2010, the Two-Lane Tunnel Concept would increase vehicle miles travelled by 68.6 million relative to the No-Build Alternative (versus 17.7 million VMT increase with the Preferred Alternative). Travel time savings (PHT) realized by motorists travelling within the project area as compared to the No-Build Alternative would be reduced by 10.3 million hours per year with the Two-Lane Tunnel Concept. The Preferred Alternative results in 17.6 million hours of travel time savings in 2010. Since the movement of hazardous cargoes and emergency vehicles depends on the level of congestion on the roadway network, the Two-Lane Tunnel Concept would provide improvements over the No-Build Alternative, but not to the level of benefit realized by the Preferred Alternative.

Access to Logan Airport from the south and west (I-90 and the Southeast Expressway) would be significantly improved with the Two-Lane Tunnel Concept relative to the No-Build Alternative. Access to the Airport from all directions, however, is significantly improved with the Preferred Alternative.

The safety aspects of the Two-Lane Tunnel Concept are only slightly less than the Preferred Alternative (23 percent fewer accidents in 2010 versus 25 percent), with the Two-Lane Tunnel Concept

actually resulting in increased benefits over the Preferred Alternative on the local roadway network.

The Preferred Alternative and the Two-Lane Tunnel Concept alternatives would both reduce the usage of public transportation to and from the Airport due to the improved vehicular access. However, unlike the Two-Lane Tunnel Concept, the Preferred Alternative includes design features--exclusive bus lanes, better highway-to-highway connections--which provide incentives for increased usage of public transportation on a regional basis. In addition, with less congestion to contend with (due to improved travel times for buses that benefit along with all other vehicles which will be using the improved highway system), it is likely that peak period bus services will become somewhat more reliable with the Preferred Alternative than with the Two-Lane Tunnel Concept.

Construction impacts of the Preferred Alternative and the Two-Lane Tunnel Concept are fairly similar, except during the period when connections between the depressed Central Artery and the Callahan/Sumner Tunnels are being made. With the Two-Lane Tunnel Concept, traffic impacts would be somewhat greater during this period because only a two-lane Third Harbor Tunnel would be available to divert both Airport and non-Airport cross-harbor traffic during this critical time, and construction of the Callahan/Sumner Tunnel connections would be more extensive with the Two-Lane Tunnel Concept than with the Preferred Alternative.

Comparison of the Two-Lane Tunnel Concept vs. the No-Build Alternative

Traffic Volumes

o No-Build Alternative

In 2010, with the No-Build Alternative, the roadway system serving Boston will carry higher traffic volumes, on the order of 5 to 30 percent more than 1982 volumes, depending on the particular roadway link.

The major links in the core area: Interstate 93, Mystic-Tobin Bridge, Central Artery north, Callahan/Sumner Tunnels, Central Artery south, the Massachusetts Turnpike, and Southeast Expressway will experience a substantial increase in hours of congested operation; where these roadways are congested for 1 to 8 hours per day in 1982, congested operations would last from 5 to 14 hours per day in 2010 with the No-Build Alternative, with 14 hours per day occurring within the Callahan/Sumner Tunnels and on the northbound Central Artery south of the existing tunnels.

o Two-Lane Tunnel Concept

Because it provides more travel lane capacity, the Two-Lane Tunnel Concept reduces the hours of congested operation expected in 2010 with the No-Build Alternative. In 2010, the Two-Lane Tunnel Concept would result in congestion lasting from 1 to 5 hours per day on all key routes except the Southeast Expressway, which would experience about the same number of hours of congestion as the No-Build Alternative.

The Two-Lane Tunnel Concept features a two-lane Third Harbor Tunnel, elimination of the High-Level Bridge bottleneck, and the widening of the Central Artery from 6 to 8 lanes (ten lanes in some areas). These features provide substantial reductions in Central Artery congestion relative to the No-Build Alternative.

In 2010, the Two-Lane Tunnel Concept would redistribute traffic flow patterns compared to the No-Build Alternative. Traffic volumes would be reduced on links which are currently overloaded, including the Callahan/Sumner Tunnels and Central Artery south of these tunnels; links such as Interstate Route 93 and the

Massachusetts Turnpike, which are currently underutilized, would carry more traffic. Furthermore, this Concept would reduce Callahan/Summer AWDT by 16 percent in 2010. Compared to the No-Build Alternative, the Two-Lane Tunnel Concept would also decrease volumes on the Mystic-Tobin Bridge and increase volumes on Route 1A north of the Airport, including Bell Circle.

Central Artery Queues

Traffic benefits of the Two-Lane Tunnel Concept on Central Artery bottlenecks and queuing, and benefits on local streets, reflect its effectiveness in achieving an overall transportation improvement. Generally, because of its depressed, widened Central Artery and two-lane Third Harbor Tunnel, some traffic benefits are realized. However, queues would still occur along the Central Artery due to back-ups at the Callahan/Summer Tunnels and the Third Harbor Tunnel entrance. In 2010, the Two-Lane Tunnel Concept would provide 24 percent shorter individual queues during peak hours on the Central Artery than the No-Build Alternative.

Vehicle Miles Travelled (VMT)

In 2010, the Two-Lane Tunnel Concept generates approximately 68.6 million more VMT per year than the No-Build Alternative.

Person Hours Travelled (PHT)

In 2010, the Two-Lane Tunnel Concept generates approximately 10.3 million less PHT per year than the No-Build Alternative.

Vehicle Hours Travelled (VHT)

In 2010, the Two-Lane Tunnel Concept generates approximately 7.6 million more VHT per year than the No-Build Alternative.

Levels of Service (LOS)

In 2010, the Two-Lane Tunnel Concept would reduce the number of roadway links and local intersection operating at LOS E or F compared to the No-Build Alternative and, conversely, increase the number of roadway links and intersections operating at LOS A-D.

In the 2010 PM peak hour, the No-Build Alternative results in onl 35 percent of analyzed regional highway links operating at LOS A-D, while the Two-Lane Tunnel Concept results in 57 percent of all links ramps operating at LOS A-D, a significant transportation improveme

Similarly, the Two-Lane Tunn Concept increases the percentage of local streets operating at LOS A-D compared to the No-Build Alternativ With the No-Build Alternative, 43 percent of the 2010 PM peak hour intersections analyzed in South Boston, downtown Boston, and East Boston (including Bell Circle) will operate at LOS A-D. The Two-Lane Tunnel Concept would increase this level of traffic service benefit percent.

Safety

The Two-Lane Tunnel Concept also reduces accident potential on regional highway system in comparisc to the No-Build Alternative (by 23 percent in 2010). On local streets accident potential would be reduced six percent compared to the No-Build Alternative.

Hazardous Cargoes

Due to improved routings and decreased vehicle hours and vehicle miles travelled, benefits to the movement of hazardous cargoes are a realized with the Two-Lane Tunnel Concept. Vehicles carrying hazardou cargoes would encounter fewer hours congestion than will occur with the No-Build Alternative on the Central Artery and in the Callahan/Summer Tunnels. Hazardous cargo vehicles with origins or destinations in Sout Boston would encounter less congesti than found with the No-Build Alternative.

Emergency Vehicle Access

Emergency vehicle access is also improved with the Two-Lane Tunnel Concept as a result of reductions in travel time on the regional and local highway network.

Logan Airport

The Two-Lane Tunnel Concept is slightly more effective at reducing congestion both north of the existing tunnels on Route 1A and for Airport users approaching from Interstate Route 93 and Storrow Drive than the No-Build Alternative. The No-Build Alternative results in substantial congestion on local East Boston routes leading to the Airport.

Public Transportation

Public transportation services would not be significantly interrupted during the construction phase of the Two-Lane Tunnel Concept. In the long term, some Airport-related trips would be diverted from mass transit, buses, taxicabs, limousines, etc. back to the private automobile.

Construction Staging

Traffic congestion would be minimized by careful phasing of construction work.

With the No-Build Alternative, redecking the Central Artery in the double-decked area north of Causeway Street will reduce the capacity of the Artery during the construction period, resulting in more hours of congestion each day and longer peak period queues. Therefore, the No-Build Alternative has a substantial impact on regional traffic flow.

However, the No-Build Alternative (with redecking) involves significantly fewer years of construction and less disruption of the Surface Artery and surface street system than the Two-Lane Tunnel Concept. There will, however, be some disruption of local street traffic as congestion on the Central Artery will result in much more short-cutting through areas in South Boston, downtown Boston, and East Boston than at present.

The result of this construction period disruption would be a Central Artery with the same vehicular capacity as today and even more congestion due to the higher traffic volumes anticipated in the long term.

With the Two-Lane Tunnel Concept, construction of the South Boston portion of the Third Harbor Tunnel would commence simultaneously with the work on the depression of the Central Artery. With this staging, the Third Harbor Tunnel would be available for use prior to the completion of the depressed Central Artery. This would be particularly critical during the period when the Callahan/Sumner tunnels would be reduced in capacity while connections are completed to the depressed Central Artery. The availability of a Two-Lane Third Harbor Tunnel serving only Logan Airport would slightly reduce demands on the Central Artery during its reconstruction: however, six lanes can be kept in operation on the elevated Central Artery until the depressed mainline is open to traffic.

3.1.2 Traffic Volumes

Average Weekday Daily Traffic (AWDT)

Average weekday daily traffic (AWDT) volumes for regional and local roadway links are summarized in Table 10 for existing conditions and for the forecast years of 1990 and 2010 for both the No-Build and the Two-Lane Tunnel Concept.

Unlike existing volumes which are based on actual ground counts, future traffic volumes are "demand volumes. These demand volumes, in some cases, exceed service or actual volumes that will occur at individual roadway locations. Where indicated demand volumes are lower than capacity, they represent anticipated traffic flow conditions. Where indicated demand volumes exceed the

ability of a roadway to handle them, the implication is that peak hour congestion would spread into earlier and later hours of the day. The higher the demand volume to capacity ratio, the longer peak congestion would prevail.

New vehicular traffic results from improved vehicular accessibility to Logan Airport. The improved cross-harbor capacity resulting from the Two-Lane Tunnel Concept is expected to increase traffic to Logan Airport by reducing the average vehicle occupancy rates of the No-Build Alternative. It does not increase the number of person-trips to the Airport. This is expected to result in an estimated 12,800 additional daily vehicle trips to the Airport.

The traffic diversion component (6,200 vehicles per day) of the cross-harbor traffic increase (19,000 vehicles per day) primarily results from more traffic using the Two-Lane Third Harbor Tunnel and existing harbor crossings to gain access to the Airport rather than local streets and crossings (primarily from Charlestown and Cambridge streets which were diverting from I-93 and Route 1 to access downtown Boston) because of the increased capacity, improved alternative routings, and improved traffic service potential (i.e., decreased travel times) on these main line routes versus local street routes.

Highway Network AWDT

Traffic Growth Without the Project. Section 3.1 of the FEIS/FEIR details anticipated traffic growth for the No-Build Alternative between 1982 and 2010. Anticipated AWDT traffic growth on the regional highway network is as follows:

Typical 1982 - 2010 AWDT Increase
(No-Build Alternative)

Interstate Route 93:	19%
Mystic-Tobin Bridge:	9%
Storrow Drive:	8%
Callahan/Sumner Tunnels:	11%

Typical 1982 - 2010 AWDT Increase (cont.)

Central Artery:	10%
Massachusetts Turnpike:	12%
Southeast Expressway:	5%
Route 1A (north of the Airport):	30%

The high traffic increase on Route 1A north of the Airport reflects both the availability of excess highway capacity on this route and anticipated significant increases in airport-related traffic. Similarly, the increase in 2010 traffic on Interstate Route 93 reflects the excess capacity and expected population growth in the corridor it serves.

Future AWDT with the Two-Lane Tunnel Concept. The percentage comparisons of the Two-Lane Tunnel Concept versus the No-Build Alternative AWDT volumes for the year 2010 are contained in Table 11.

On a typical weekday, the Two-Lane Tunnel Concept would reduce AWDT by 16 percent in the existing Callahan/Sumner Tunnels when compared to the No-Build Alternative.

The Mystic-Tobin Bridge would also be expected to experience a reduction of 11 percent in AWDT with the Two-Lane Tunnel Concept.

Compared to the No-Build Alternative, the Two-Lane Tunnel Concept increases AWDT by 2 percent on the Central Artery south of the existing tunnels but north of High Street. Volumes on the Central Artery to the north of the existing tunnels would increase by about 17 percent with the Two-Lane Tunnel Concept. However, this additional traffic can be handled with the Two-Lane Tunnel Concept; the capacity of the Central Artery would be increased by 33 percent since it would be widened from 6 to 8 lanes in this area.

In the northern part of the study area, at the Revere/East Boston line, Route 1A is expected to carry about 11 percent more traffic with the

Table 10

AVERAGE WEEKDAY DAILY TRAFFIC (AWDT) 1982, 1990, 2010
NO-BUILD ALTERNATIVE AND TWO-LANE TUNNEL CONCEPT

ROADWAY LINKS	1982 EXISTING	1990 NO-BUILD	1990 2-LANE TUNNEL	2010 NO-BUILD	2010 2-LANE TUNNEL
THIRD HARBOR TUNNEL	N/A	N/A	32,000	N/A	42,100
SUMNER/CALLAHAN TUNNEL	82,800	83,600	71,200	91,800	77,300
TOBIN BRIDGE-north of I-93 RAMPS	72,500	73,900	65,500	79,100	70,500
I-93 north of TOBIN BRIDGE RAMPS	89,450	102,200	110,800	106,000	114,300
CENTRAL ARTERY					
between I-93 & Storrow Dr. Ramps	142,100	148,300	174,100	153,800	179,500
between Causeway St. & Summer/Callahan Tunnels	161,700	167,500	168,400	173,100	176,200
between Sumner/Callahan & High St. Ramps	164,500	169,300	192,700*	173,400	197,200
between Atlantic Ave. & Beech St. Ramps	166,200	169,500	157,700	161,500	108,600
between Albany St. & Mass. Ave. Ramps	153,700	167,200	174,400	169,400	179,400
S.E. EXPRESSWAY					
between Columbia Rd. & Southampton St. Ramps	162,300	168,000	170,300	170,900	165,300
south of Columbia Rd. Ramps	151,620	156,900	154,600	159,650	149,200
MASS. TURNPIKE-west of Central Artery	71,200	79,600	91,800	80,000	96,800
STORROW DR.-west of Copley Ramps	84,000	86,100	76,400	90,600	80,500
ROUTE 1A-north of Neptune Road	30,825	35,800	25,150	40,000	38,800
LOGAN AIRPORT ACCESS/EGRESS RDS. (Main)	55,450	66,300	55,500	82,100	67,200
POKTER ST.-between Cottage & Wellington Sts.	8,425	10,000	7,200	11,700	8,600
MAVERICK ST.-between Cottage & Orleans Sts.	4,200*	4,300*	4,300*	4,700*	4,500*
SUMNER ST.-between Orleans & Cottage Sts.	2.400*	2,500*	2,500*	2,700*	2,700*
MERIDIAN ST.-northwest of Condor St.	15,100	17,700	15,900	18,300	17,300
BENNINGTON ST.-west of Route 1A	19,125	20,000	21,100	21,100	22,485
COLUMBIA RD.-north of Columbia Circle	21,750	25,875	22,675	27,350	24,075
L STREET-north of Day Blvd.	12,325	13,825	13,825	14,150	14,125
EAST FIRST ST.-west of Summer St.	2,900	4,550	4,500	4,800	4,750
D STREET-southwest of Summer St.	6,500	9,925	8,600	10,900	9,200
SUMMER ST.-at Fort Point Channel	27,000	35,475	33,640	36,450	36,500
CONGRESS ST.-at Fort Point Channel	11,000	14,550	16,500	15,550	17,800
NORTHERN AVE.-at Fort Point Channel	18,050	30,250	32,650	32,350	34,000
DORCHESTER AVE.-south of A Street	23,450	25,450	23,750	25,650	25,050
DORCHESTER AVE.-south of Summer St.	N/A	N/A	N/A	N/A	N/A
FRONTAGE RD.-approach to W. Fourth St. Bridge	26,950*	27,200*	24,500*	27,600*	29,000*
WEST FOURTH STREET BRIDGE	11,000	10,650	10,650	10,650	11,150
BROADWAY BRIDGE	20,600	26,150	26,150	26,150	26,550
ATLANTIC AVE.-between Summer & Congress Sts.	16,900*	20,300*	19,900*	20,700*	19,700*
SEAPORT ACCESS RD.-southwest of Summer St.	N/A	8,300	N/A	9,300	N/A
STATE ST.-between Atlantic Ave. & Surface Artery	5,100*	10,400*	10,900*	12,500*	11,000*
NORTH ST.-between Congress & Blackstone Sts.	16,500	19,800	11,100*	25,800	11,800
NORTH WASHINGTON ST.-between Keany Sq. & Cross St.	21,550	34,400	27,200	35,100	30,600
CROSS ST.-between Hanover & North Washington Sts.	25,200*	27,800*	13,700*	31,000*	15,100*
NEW CHARDON ST.-between North Washington & Merrimac Sts.	17,300*	20,300*	18,900*	25,000*	21,200
MERRIMAC ST.-between New Chardon & Sudbury Sts.	16,650	18,000	19,400	19,900	20,200
NEW SUDBURY ST.-between Congress & Blackstone Sts.	12,450*	13,500*	27,300*	20,200*	28,800*
COMMERCIAL ST.-northeast of Keany Sq.	18,650	20,500	16,700	24,800	17,400
CAUSEWAY ST.-southwest of Keany Sq.	22,150	24,500	13,600	25,600	13,400
HANOVER ST.-northeast of Cross St.	4,150	5,000	7,500	5,300	7,800
CONGRESS ST.-between Sudbury & North Sts.	18,500	27,000	30,100	29,200	31,800
NORTH WASHINGTON ST.-between Keany & City Sqs.	44,000	45,600	27,200	49,200	33,200

* One-way Volume

N/A - not applicable for this alternative

Table 11

PERCENTAGE CHANGE YEAR 2010 AWDT: TWO-LANE TUNNEL CONCEPT

ROADWAY LINKS	2010 ALT. 1	2010 % Change 2-LANE TUNNEL
THIRD HARBOR TUNNEL	N/A	
SUMNER/CALLAHAN TUNNEL	91,800	-16
TOBIN BRIDGE-north of I-93 RAMPS	79,100	-11
I-93 north of TOBIN BRIDGE RAMPS	106,000	+8
CENTRAL ARTERY		
between I-93 & Storrow Dr. Ramps	153,800	+17
between Causeway St. & Summer/Callahan Tunnels	173,100	+2
between Sumner/Callahan & High St. Ramps	173,400	+14
between Atlantic Ave. & Beech St. Ramps	173,100	-7
between Albany St. & Mass. Ave. Ramps	169,400	+6
S.E. EXPRESSWAY		
between Columbia Rd. & Southampton St. Ramps	170,900	-3
south of Columbia Rd. Ramps	159,650	-7
MASS. TURNPIKE-west of Central Artery	80,000	+21
STORROW DR.-west of Copley Ramps	90,600	-11
ROUTE 1A-north of Neptune Road	40,000	-3
LOGAN AIRPORT ACCESS/EGRESS RDS. (Main)	82,100	-18
PORTER ST.-between Cottage & Wellington Sts.	11,700	-26
MAVERICK ST.-between Cottage & Orleans Sts.	4,700*	-4
SUMNER ST.-between Orleans & Cottage Sts.	2,700*	0
MERIDIAN ST.-northwest of Condor St.	18,300	-5
BENNINGTON ST.-west of Route 1A	21,100	+7
COLUMBIA RD.-north of Columbia Circle	27,350	-12
L STREET-north of Day Blvd.	14,150	0
EAST FIRST ST.-west of Summer St.	4,800	-1
D STREET-southwest of Summer St.	10,900	-16
SUMMER ST.-at Fort Point Channel	36,450	+1
CONGRESS ST.-at Fort Point Channel	15,550	+14
NORTHERN AVE.-at Fort Point Channel	32,350	+5
DORCHESTER AVE.-south of A Street	25,650	-2
DORCHESTER AVE.-south of Summer St.	N/A	
FRONTAGE RD.-approach to W. Fourth St. Bridge	27,600*	+5
WEST FOURTH STREET BRIDGE	10,650	+5
BROADWAY BRIDGE	26,150	+2
ATLANTIC AVE.-between Summer & Congress Sts.	20,700*	-5
SEAPORT ACCESS RD.-southwest of Summer St.	9,300	
STATE ST.-between Atlantic Ave. & Surface Artery	12,500*	-12
NORTH ST.-between Congress & Blackstone Sts.	25,800	-54
NORTH WASHINGTON ST.-between Keany Sq. & Cross St.	35,100	-13
CROSS ST.-between Hanover & No. Washington Sts.	31,000*	-51
NEW CHARDON ST.-between North Washington & Merrimac Sts.	25,000*	-15
MERRIMAC ST.-between New Chardon & Sudbury Sts.	19,900	-2
NEW SUDBURY ST.-between Congress & Blackstone Sts.	20,200*	+43
COMMERCIAL ST.-northeast of Keany Sq.	24,800	-30
CAUSEWAY ST.-southwest of Keany Sq.	25,600	-48
HANOVER ST.-northeast of Cross St.	7,800	+47
CONGRESS ST.-between Sudbury & North Sts.	29,200	+9
NORTH WASHINGTON ST.-between Keany & City Sqs.	49,200	-48

* One-way Volume

N/A - not applicable for this alternative

Two-Lane Tunnel Concept than the No-Build Alternative. South of the Route 1A Bennington Street ramps, AWDT with the Two-Lane Tunnel Concept would be about 3 percent lower than in the No-Build Alternative. This suggests that, during peak hours of congestion, non-airport traffic will divert nearly as much to East Boston local streets with the Two-Lane Tunnel Concept as with the No-Build Alternative because of congestion on Route 1A approaching the Sumner Tunnel.

AWDT on the Massachusetts Turnpike (Interstate Route 90) is expected to increase by 21 percent with the Two-Lane Tunnel Concept, due to its direct connections to the Massachusetts Turnpike, and due to the increased capacity of the Central Artery (which diverts traffic from Storrow Drive to the Massachusetts Turnpike). Storrow Drive AWDT is expected to decrease by 11 percent when compared to the No-Build Alternative. AWDT changes on the remaining regional highway network would be 7 percent or less, expressed as a percentage of anticipated traffic volumes under the No-Build Alternative.

Total harbor crossings (Mystic-Tobin Bridge, Callahan/Sumner Tunnels, and the Third Harbor Tunnel) would increase with the Two-Lane Tunnel Concept by 11 percent -- 19,000 vehicles per day. This increase represents both new vehicular traffic as discussed previously and traffic diverted from other local routes. Furthermore, it reflects the extra cross-harbor capacity created through the combination of existing tunnels with the Third Harbor Tunnel, improvements at the existing tunnel entrance, and the increased capacity of the Central Artery.

Year 2010 AWDT volumes in the Third Harbor Tunnel would be 42,100 vehicles per day, 31 percent lower than the 61,400 vehicles per day expected in the Callahan/Sumner tunnels. This is because: 1) the capacity of the Two-Lane Third Harbor Tunnel is lower than that of the existing Callahan/Sumner Tunnel one-way pair, and 2) it only serves Airport traffic and therefore, demand is lower than it would be if all cross-harbor traffic demand was diverted to it.

Local Street AWDT

AWDT Growth without the Project. To summarize findings provided in Section 3.1, anticipated traffic growth on local streets in South Boston, downtown Boston, and East Boston without the proposed project between 1982 and 2010 are the following:

South Boston AWDT:

- Substantial AWDT increases (up to 52 percent) will occur on the selected roadway links between 1982 and 2010.
- The greatest AWDT increases (in excess of 35 percent) will occur on the Fort Point Channel bridges (Northern Avenue, Congress Street, and Summer Street) and streets which provide access to the northern industrial sector of South Boston (East First Street, D Street). This area is expected to experience a significant increase in development.
- AWDT increases on the remaining selected roadway links will be less than 30 percent; negligible changes (less than 10 percent) will occur on Dorchester Avenue south of A Street, Frontage Road, and West Fourth Street.
- The future Seaport Access Road (to be constructed by others with the No-Build Alternative only) will connect Northern Avenue with West Second Street and will carry 9,300 vpd in 2010 south of Summer Street

Downtown Boston AWDT:

- Due to increased density of employment generators in many

different parts of downtown Boston, as well as diversions from limited access highways operating at or near capacity conditions, traffic on selected local streets is expected to increase substantially in the future -- on the average about 43 percent -- with the No-Build Alternative.

- The largest increases in No-Build Alternative volumes for selected local streets are expected on North Washington Street (13,500 vpd) between Keany Square and Cross Street, and on Congress Street (10,700 vpd) between Sudbury and North Streets.

- The lowest anticipated volume increases (15 to 20 percent range) were found on Merrimac and Causeway Streets (3,350 to 3,450 vpd).

East Boston AWDT:

- Airport access/egress roads will experience a 48 percent increase in AWDT between 1982 and 2010 because of significant increases in air travel demand as well as future Airport development (specifically, Bird Island Flats).

- Selected roadway links (Bennington, Maverick, Sumner, and Meridian Streets) will experience AWDT increases ranging from 10 to 21 percent.

- Porter Street (assuming airport connections), would experience a 39 percent increase in traffic.

Comparison of Future AWDT's Under the Two-Lane Tunnel Concept and the No-Build Alternative

South Boston AWDT. AWDT's on selected links in South Boston generally decrease with the Two-Lane Tunnel Concept.

AWDT projections indicate that the Two-Lane Tunnel Concept diverts a substantial amount of trucks and automobiles from South Boston Streets when compared to the No-Build Alternative. A discussion of the magnitude of the truck problem in South Boston is given in Section 4.2 of the FEIS/FEIR. Projections for year 2010 AWDT indicate that 9,300 vehicles per day will use the Seaport Access Connector with the No-Build Alternative. With the Two-Lane Tunnel Concept, compared to the No-Build Alternative, truck volumes in the northern industrial area of South Boston are reduced somewhat. Approximately 2,200 trucks per day, (about 170 in each of the peak traffic hours), would be diverted from South Boston local streets -- e.g., Dorchester Avenue, Boston Street, Southampton Street, First Street, etc. These vehicles, instead of using local South Boston Streets, would travel via the new Northern Avenue/Congress Street Ramps and Seaport Access Alignment Tunnel between the Third Harbor Tunnel, the Central Artery, and the Southeast Expressway in the area north of Columbia Circle

The Two-Lane Tunnel Concept also reduces volumes slightly (-2 percent) on Dorchester Avenue south of A Street. Because the Two-Lane Tunnel has less capacity than a four-lane tunnel, and does not include a relocated Dorchester Avenue, diversions are not as significant as with the Preferred Alternative as described in the FEIS/FEIR.

The effectiveness of the two new South Boston interchanges in reducing truck traffic is somewhat reduced during the peak travel hours because of anticipated congestion on the approaches to the Two-Lane Third Harbor Tunnel.

With the Two-Lane Tunnel Concept, AWDT's on Northern Avenue and Congress Street at the Fort Point Channel are slightly (1 to 5 percent) higher than the No-Build Alternative due to the Third Harbor Tunnel

connections to the east.

East Boston AWDT. In East Boston, traffic generally would be reduced or stay the same with the Two-Lane Tunnel Concept compared to the No-Build Alternative. In 2010, the Logan Airport access roads, Meridian Street northwest of Condor Street, and Porter Street between Cottage and Wellington Streets would benefit most. Meridian Street traffic would decrease by 1,000 vehicles per day or 5 percent. Porter Street traffic would be expected to decrease by 26 percent. Except for a 7 percent increase in Bennington Street traffic volumes, the other selected street links are expected to have volumes similar to the No-Build Alternative.

Downtown Boston AWDT. Traffic volumes on downtown Boston streets with the Two-Lane Tunnel Concept, with the exception of the streets mentioned below, are expected to be lower than or equal to those found with the No-Build Alternative (although higher than found with alternatives which include a four-lane Third Harbor Tunnel).

In downtown Boston, future AWDT volumes on the streets selected for analysis are influenced by the design features of the Two-Lane Tunnel Concept. For example, with the Two-Lane Tunnel Concept, year 2010 AWDT volumes on North Street are 54 percent lower than the No-Build Alternative because North Street would no longer have direct access to Interstate Route 93 northbound. New Sudbury Street volumes would be substantially higher with the Two-Lane Tunnel Concept than will occur with the No-Build Alternative. This is primarily because of the new ramp connections from the Sumner Tunnel and the southbound Central Artery at Causeway Street. North Washington Street traffic in the Haymarket Square area would be 13 percent lower due to the addition of ramp traffic from the Sumner Tunnel to Surface Artery traffic. Cross Street between Hanover and North Washington Streets would experience a 51 percent decrease over the No-Build Alternative because it would no longer be accommodating traffic directly out of the Sumner Tunnel.

AWDT volumes on a few downtown streets carrying north-south traffic roughly parallel to the Central Artery, such as Commercial and Merrimac Streets, would decrease by 2 to 30 percent due to traffic diversions back to the Central Artery. However, this reduction would be somewhat offset by a 9 percent increase in AWDT on Congress Street.

Peak Hour Traffic

AM and PM peak hour traffic volumes for the years 1982, 1990, and 2010 are summarized in Table 12.

Figure 24 shows the roadway links, ramps and intersections analyzed for the existing network. Figure 25 locates the links ramps, and intersections analyzed with the Two-Lane Tunnel Concept as listed in Table 12.

Affected Highway Network Peak Hour Traffic

During the AM and PM peak hours, No-Build Alternative traffic volumes will increase substantially between 1982 and 2010. In addition to congestion and queuing which now occurs during peak hours, peak periods of congestion are expected to extend into additional hours of the day to accommodate increased traffic volumes. Volumes on the Southeast Expressway/Central Artery will be particularly high in both directions in the AM and PM peak hours, aggravated by increased traffic on the Massachusetts Turnpike (Interstate Route 90), Interstate Route 93, Route 1, and Route 1A corridors. Peak traffic volumes in the Callahan Tunnel are expected to increase by 40 percent while volumes in the Sumner Tunnel are expected to increase by 20 percent between 1982 and 2010. Mystic-Tobin Bridge peak hour traffic is expected to increase by 15 to 25 percent, depending upon the direction and the

Table 12
PEAK HOUR TRAFFIC VOLUMES
1982, 1990 AND 2010

	EXISTING		NO-BUILD ALTERNATIVE				TWO-LANE TUNNEL			
	1982		1990		2010		1990		2010	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
MAJOR HIGHWAY LINKS - NORTHBOUND										
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	7450	4350	8780	6030	9650	6590	9320	6180	9900	6700
L2N. Frontage Road: Adjacent to Mass. Ave. Interchange	2580	1700	2770	1630	2810	1630	2460	1310	2640	1390
L13N. S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA	NA	NA	NA	NA	NA	8250	5670	9360	6190
L14N. S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA	NA	NA	NA	NA	NA	8520	5850	9700	6630
L16N. Fort Point Channel Tunnel: Before Merge with Central Artery Roadway	NA	NA	NA	NA	NA	NA	650	1000	650	1150
L19N. Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	1030	1260	1250	1740
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	5780	3920	7940	5850	9420	6360	NA	NA	NA	NA
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	6450	4200	7410	5620	9500	5620	NA	NA	NA	NA
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	5030	4080	5740	5740	6420	6030	6920	7100	8280	7100
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	5540	4700	6000	5810	7220	6070	NA	NA	NA	NA
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	3660	5350	3570	5740	4790	5850	4600	5330	5430	5330
L8N. Mystic Tobin Bridge: North of I-93 Ramps	1580	3120	1900	3400	2010	3590	1900	3260	1980	3370
L9N. I-93: North of Tobin Bridge Ramps	2000	4290	2240	4290	2740	4400	2360	3070	2890	4510
L10N. Callahan Tunnel	2300	2850	2660	3740	3150	4070	1980	2890	2510	3070
L25N. Central Artery Tunnel: Before Atlantic Ave. On-Ramp	NA	NA	NA	NA	NA	NA	5740	4920	6990	5140
L27N. Central Artery: Btwn. Sumner On- and Storrow Off-Ramps	NA	NA	NA	NA	NA	NA	5130	5250	6380	5250
L28N. Central Artery: Btwn. Causeway On- and Storrow On-Ramps	NA	NA	NA	NA	NA	NA	3910	4180	4450	4180
L29N. Central Artery Tunnel: Btwn. Frontage On- and Connector CN-AT	NA	NA	NA	NA	NA	NA	6730	4980	7970	5330
L30N. Connector: Mass. Turnpike to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	1630	590	1670	740
L31N. Third Harbor Tunnel: Btwn. Connector CN-AT and Congress Off-Ramp	NA	NA	NA	NA	NA	NA	2920	1650	3270	2100
L11N. Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	2050	2580	2470	3330	2890	3590	2010	2920	2320	3110
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	930	2230	1220	2440	1330	2700	1330	2630	1480	2960
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND										
L1E. Mass. Turnpike, Eastbound; West of Expressway Ramps	4400	2080	4830	2520	4860	2920	4830	2740	5050	3110
L1W. Mass. Turnpike, Westbound; West of Expressway Ramps	1450	3180	2550	3400	2700	3660	2810	3690	2830	4110
L2E. Storrow Drive, Eastbound; West of Copley Square Ramps	3450	2600	3460	3000	3990	3110	3500	2850	4140	2920
L2W. Storrow Drive, Westbound; West of Copley Square Ramps	2430	3440	3340	3960	3340	4030	3040	3740	4140	3890
MAJOR HIGHWAY LINKS - SOUTHBOUND										
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	3370	5350	5130	8290	5660	8770	5280	8700	5740	9140
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	3920	6150	5700	9360	6190	10430	5740	9740	6190	10100
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	4540	5750	5170	8360	5400	8700	5210	8920	5360	9400
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	4350	4570	5520	8070	6160	8330	NA	NA	NA	NA
L16S. Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA	NA	NA	NA	NA	NA	4560	6920	4640	7400
L17S. Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA	NA	NA	NA	NA	NA	3270	4660	3340	5070
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	4730	4500	5430	6550	5700	6880	NA	NA	NA	NA
L18S. Central Artery Local Rdwy: Btwn. Purchase On - and Beach Off-Ramps	NA	NA	NA	NA	NA	NA	2770	3700	2930	4290
L19S. Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	650	1050	760	1440
L20S. Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	NA	NA	NA	NA	2580	2330	2740	2740
L21S. Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	NA	NA	NA	NA	2810	2960	2890	2960
L6S. Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	5050	3880	5590	5960	5850	6140	NA	NA	NA	NA
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	5850	3530	5740	5220	6190	5400	NA	NA	NA	NA
L22S. Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA	NA	NA	NA	NA	NA	6840	5990	7070	6180
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	5570	3550	5470	4850	6080	5180	NA	NA	NA	NA
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	5220	2740	5170	4140	6190	4180	NA	NA	NA	NA
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	5430	3710	4790	4030	6190	4030	5360	4550	7870	4550
L11S. Mystic Tobin Bridge: North of I-93 Ramps	3060	2180	3340	2220	3720	2480	3270	2040	3530	2180
L12S. I-93: North of Tobin Bridge Ramps	3980	2150	3460	2850	4030	3000	3880	3070	4830	3070
L13S. Sumner Tunnel	3160	2640	3460	2810	3690	3260	3040	2150	3460	2480
L30S. Central Artery: Btwn. Storrow On- and Callahan Off-Ramps	NA	NA	NA	NA	NA	NA	4940	4480	5850	4700
L23S. Fort Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA	NA	NA	NA	NA	NA	540	1320	660	1370
L31S. Third Harbor Tunnel: Btwn. Congress On- and Mass. Tpk. Off-Ramps	NA	NA	NA	NA	NA	NA	920	1970	1100	2330
L14S. Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	1510	1930	1630	1780	1750	2070	1440	1520	1520	1780
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	1750	1620	1440	1040	1440	1150	1520	1150	1670	1300
L27S. Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA	NA	NA	NA	NA	NA	2020	2190	3840	4120

NA = Not Applicable for this Alternative

Table 12 (cont.)
PEAK HOUR TRAFFIC VOLUMES
1982, 1990 AND 2010

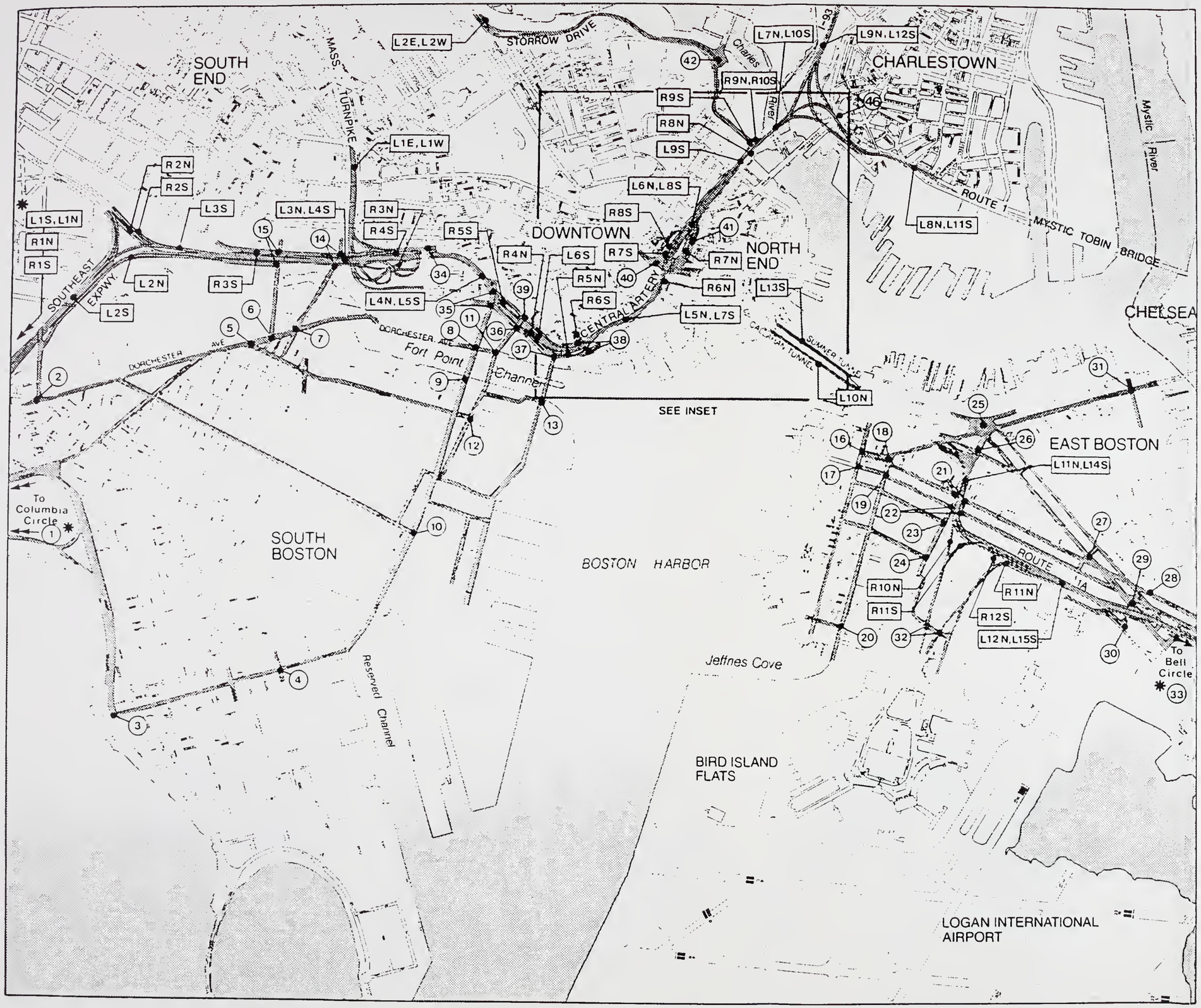
	EXISTING		NO-BUILD ALTERNATIVE				TWO-LANE TUNNEL			
	1982		1990		2010		1990		2010	
MAJOR HIGHWAY RAMPS - NORTHBOUND	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
R1N. Columbia Rd. Off; from S.E. Expressway	500	260	570	300	680	330	570	150	680	150
R2N. Mass. Avenue On; to S.E. Expressway	460	200	1520	700	2010	700	1370	850	2050	890
R13N. Ramp: Frontage Rd. to Fort Point Channel Tunnel	NA	NA	NA	NA	NA	NA	340	780	340	930
R3N. Mass. Tpk. On; to Central Artery	1600	700	1750	700	2320	700	NA	NA	NA	NA
R4N. Atlantic Ave. Off; from Central Artery	2360	1540	3840	2110	4940	2110	NA	NA	NA	NA
R5N. Atlantic Ave. On; to Central Artery	220	800	840	1000	840	1150	1180	2180	1290	2180
R6N. Callahan Tunnel Off; from Central Artery	1330	730	1250	1410	1330	1550	NA	NA	NA	NA
R7N. Sumner Tunnel On; to Central Artery	1420	1350	1560	1520	2130	1590	950	810	1630	960
R8N. Storrow Drive Off; from Central Artery	1900	1100	1820	1630	2470	1670	1750	2180	2740	2550
R9N. Storrow Drive On; to Central Artery	1200	2000	1200	2250	1400	2300	650	1180	950	1180
R23N. Callahan Tunnel/Cross St. Off; from Central Artery	NA	NA	NA	NA	NA	NA	2740	2630	3530	2890
R24N. Causeway St. On; to Central Artery	NA	NA	NA	NA	NA	NA	530	1110	800	1110
R17N. Connector: Central Artery to Mass. Tpk./Kneeland St.	NA	NA	NA	NA	NA	NA	2280	1740	2360	1890
R26N. W. Fourth St. On; to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	490	870	630	910
R27N. Mass. Turnpike On; to Fort Point Channel Tunnel	NA	NA	NA	NA	NA	NA	300	220	420	220
R28N. Connector: Central Artery to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	1700	1050	1700	1360
R31N. Ramp: Third Harbor Tunnel to Congress St./S. Boston Access Rd.	NA	NA	NA	NA	NA	NA	1970	460	2130	510
R29N. Congress St. Off; from Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	1310	210	1360	210
R30N. Congress St. On; to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	80	70	110	150
R32N. South Boston Access Road	NA	NA	NA	NA	NA	NA	660	250	760	300
R33N. Ramp: South Boston Access Road to Summer St.	NA	NA	NA	NA	NA	NA	270	90	300	110
R34N. Ramp: South Boston Access Road to Northern Ave.	NA	NA	NA	NA	NA	NA	390	160	460	180
R10N. Airport Off; from Route 1A	1390	1270	1710	1850	2130	2110	1140	1260	1410	1370
R11N. Airport On; to Route 1A	270	920	460	960	570	1220	460	970	570	1220
R20N. Ramp: Third Harbor Tunnel to Airport	NA	NA	NA	NA	NA	NA	950	1110	1180	1520
R35N. Ramp: Third Harbor Tunnel to Bird Island Flats	NA	NA	NA	NA	NA	NA	80	110	80	190
MAJOR HIGHWAY RAMPS - SOUTHBOUND										
R1S. Columbia Rd. On; to S.E. Expressway	400	1900	400	1980	480	2050	150	810	190	850
R2S. Mass. Ave. Off; from S.E. Expressway	720	500	720	640	860	720	80	220	80	300
R3S. Albany St. On; to S.E. Expressway	600	1900	490	2290	490	2290	680	2000	690	2000
R13S. Ramp: Fort Point Channel Tunnel to S.E. Expressway	NA	NA	NA	NA	NA	NA	310	1010	350	1010
R14S. Ramp: Fort Point Channel Tunnel to Albany St.	NA	NA	NA	NA	NA	NA	230	310	310	380
R15S. Ramp: Fort Point Channel Tunnel to Mass. Tpk.	NA	NA	NA	NA	NA	NA	420	650	440	960
R4S. Mass. Tpk./Albany St. Off; from Central Artery	1260	1300	1260	1410	1510	1670	1630	1740	1900	1740
R17S. Ramp: Mass. Tpk./Kneeland St. to Central Artery	NA	NA	NA	NA	NA	NA	1250	2290	1290	2330
R5S. Dewey Sq. Off; from Central Artery	750	480	720	520	840	520	720	590	800	590
R6S. High St. Off; from Central Artery	1300	550	1100	560	1330	560	NA	NA	NA	NA
R18S. Purchase St. On; to Central Artery	NA	NA	NA	NA	NA	NA	870	1960	990	2070
R19S. Ramp: Central Artery to Purchase St.	NA	NA	NA	NA	NA	NA	1370	700	1440	700
R7S. Haymarket On; to Central Artery	1560	1890	1750	1740	2050	1740	NA	NA	NA	NA
R8S. Callahan Tunnel Off; from Central Artery	1280	1710	1520	1370	1940	1440	800	890	1180	1000
R9S. Storrow Drive On; to Central Artery	1500	850	2050	1150	2130	1180	2130	1550	2130	2070
R10S. Storrow Drive Off; from Central Artery	1720	1820	1630	1870	2130	1920	NA	NA	NA	NA
R23S. Haymarket/Sumner Tunnel On; to Central Artery	NA	NA	NA	NA	NA	NA	2740	2410	2740	2440
R24S. Storrow Drive/Causeway St. Off; from Central Artery	NA	NA	NA	NA	NA	NA	2580	1630	3650	1630
R25S. Congress St. Off; from Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	80	190	100	300
R26S. Congress St. On; to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	190	710	210	710
R27S. Summer St./Northern Ave. on; To Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	200	400	230	470
R11S. Airport Off; from Route 1A	770	530	870	670	1030	850	870	670	970	850
R12S. Airport On; to Route 1A	530	850	1060	1400	1330	1780	790	1040	820	1220
R21S. Ramp: Airport to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	570	930	680	1300
R28S. Ramp: Bird Island Flats to Third Harbor Tunnel	NA	NA	NA	NA	NA	NA	80	110	80	150

NA = Not Applicable for this Alternative

Table 12 (cont.)
PEAK HOUR TRAFFIC VOLUMES
1982, 1990 AND 2010

INTERSECTIONS	EXISTING		NO-BUILD ALTERNATIVE				TWO-LANE TUNNEL			
	1982		1990		2010		1990		2010	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
South Boston										
1. Columbia Circle	5260	4340	6150	5030	6200	5710	5020	4640	4970	4990
2. Andrew Square	2000	1650	3070	2980	3160	3210	2750	2810	2950	2990
3. Columbia Rd./Day Blvd./L St.	1390	1450	1370	1480	1370	1530	1330	1480	1330	1520
4. L St./East First St./Summer St.	1500	1550	1890	1810	1910	1860	1900	1810	1930	1880
5. Dorchester Ave./W. 5th St./A St.	2300	2140	2410	2200	2440	2550	2250	2130	2350	2280
6. Dorchester Ave./W. 4th St.	2230	2060	2390	2100	2450	2310	2340	2030	2360	2090
7. Dorchester Ave./W. Broadway	2650	2750	2690	2210	2790	2460	2510	2080	2930	2170
8. Summer St./Dorchester Ave.	2650	2400	3120	4060	3140	4080	3170	4200	3200	4270
9. Summer St./Melcher St.	2340	2040	2800	2960	2770	3040	2680	3030	2640	3110
10. Summer St./D St.	2380	2220	2610	2570	2410	2600	2180	2490	2220	2570
11. Congress St./Dorchester Ave.	2020	1730	2300	3390	2320	3540	2230	3590	2390	3700
12. Congress St./A St.	950	1080	1240	2010	1240	2150	1660	2210	1760	2400
13. Northern Ave./Sleeper St.	1270	1730	2660	2370	2690	2410	2760	2600	2860	2700
14. Herald St./Broadway/Frontage Rd./Albany St.	3670	4140	4910	4330	4960	5000	4980	4180	5090	4790
15. Berkeley St./W. Fourth St./Frontage Rd./Albany St.	4530	4410	5910	6440	6090	5700	6330	5410	6240	5480
61. Congress St./Third Harbor Tunnel Ramps	NA	NA	NA	NA	NA	NA	1600	1400	1800	1910
62. Northern Ave./Third Harbor Tunnel Ramps Ext.	NA	NA	NA	NA	NA	NA	2010	1800	2010	2040
63. Northern Ave./Third Harbor Tunnel Ramps at General Ship	NA	NA	NA	NA	NA	NA	1250	1310	1440	1500
64. Summer St./Third Harbor Tunnel Ramps	NA	NA	NA	NA	NA	NA	1960	2150	1990	2280
East Boston and Revere										
16. Sumner St./Meridian St./Chelsea St.	620	720	690	880	690	890	760	890	760	890
17. Sumner St./Bremen St.	460	550	520	550	460	550	460	550	460	550
18. Maverick St./Meridian St./Chelsea St.	1080	1180	1030	1250	1030	1280	1030	1250	1030	1280
19. Maverick St./Bremen St.	480	510	480	540	480	540	480	540	480	540
20. Maverick St./Jeffries St./Airport Access Rd.	380	320	380	320	380	320	390	320	390	320
21. Porter St./Chelsea St./Visconti Rd.	1560	1500	2120	1850	2430	2170	1730	1520	1990	1760
22. Porter St./Bremen St.	980	1290	1000	1320	1220	1510	920	1230	1130	1390
23. Porter St./Orleans St.	570	790	820	880	1020	1030	700	790	910	920
24. Porter St./Cottage St.	540	670	770	810	990	970	670	730	870	860
25. Central Square (Meridian St./Saratoga St.)	1000	1040	1170	1210	1260	1230	1050	1100	1190	1140
26. Porter St./London St.	850	670	930	840	1060	990	830	780	950	910
27. Bennington St./Prescott St.	1150	930		NO DATA AVAILABLE				NO DATA AVAILABLE		
28. Chelsea St./East Eagle St.	1070	1190	910	940	1020	1130	770	790	870	940
29. Bennington St./Neptune Rd.	2370	1890		NO DATA AVAILABLE				NO DATA AVAILABLE		
30. McClellan Off-Ramp/Neptune Rd.	920	1460	1000	1330	1140	1460	1000	1300	1140	1460
31. Condor St./Meridian St.	1070	1330	1300	1330	1470	1630	1170	1370	1290	1480
32. Airport Crossover Roads	3630	4860	5380	6390	6640	7870	4450	5330	5290	6480
33. Bell Circle (Revere)	3860	4470	4760	5150	4870	5420	5130	5360	5190	5700
Downtown Boston and Charlestown										
34. Kneeland St./Surface Artery/S.B. On-Ramp	2550	3240	3650	4010	3370	3990	2740	2630	2380	3870
35. Dewey Sq.	3770	4890	6210	5970	5870	6280	4290	4510	4240	4590
36. Atlantic Ave./Congress St.	3040	2740	5010	4160	4490	4790	4280	3990	4380	4230
37. Atlantic Ave./Northern Ave.	2440	3560	4790	3860	4740	4440	4620	4740	4310	4820
38. Atlantic Ave./Surface Artery/High St.	3220	3420	5700	4220	6230	4070	3550	3330	3050	3650
39. Purchase St./Congress St.	2250	2970	2400	2960	2620	3140	2740	3540	2760	3750
40. North St./Blackstone St./S.B. Off-Ramp	2710	3540	4040	4000	4580	4400	2400	1810	2950	1840
41. Cross St./Hanover St./Salem St.	2070	2110	2840	2360	2680	2610	2720	2260	3560	2510
42. Leverett Circle	6720	6260	6860	6420	6560	6770	6730	6320	6590	7300
45. Congress St./North St.	1920	2300	2610	2630	3010	2630	3360	2370	4360	2320
46. City Square (Charlestown)	3690	3680	6570	7400	6050	7850	6070	6390	5450	7080
47. Causeway St./North Washington St./Commercial St.	4260	4610	4930	5910	4410	6620	4140	4980	3290	5710
48. Causeway St./Lomasney Way/Merrimac St./Staniford St.	1860	1880	2170	2280	2060	2410	2870	2350	3130	2370
49. New Chardon St./Merrimac St.	2910	2200	2700	2550	2570	2630	3250	2450	3820	2510
50. New Chardon St./North Washington St.	2640	2070	2590	2480	2360	2670	3980	4450	3610	4540
51. Sudbury St./Congress St./Merrimac St.	1760	3180	2480	3330	2280	3350	3340	4050	4190	4060
52. Surface Artery/Hanover St.	NA	NA	NA	NA	NA	NA	2510	1890	3110	1880
53. Commercial St./Hanover St.	1300	1620	1590	2260	1670	2220	1440	1370	1120	1850
54. State St./Atlantic Ave.	1560	1950	2130	2950	2260	2880	2000	2000	1860	2240
55. State St./Surface Artery	2110	2840	3060	3110	2700	3450	2930	1870	2210	2140
56. Sudbury St./Blackstone St./S.B. On-Ramp	950	1710	1870	2480	1860	2730	3070	4200	2810	4120
57. Causeway St./S.B. Off-Ramp	NA	NA	NA	NA	NA	NA	2700	2640	2920	2700
58. North Washington St. (S.B. Roadway)/S.B. Off-Ramp Ext.	NA	NA	NA	NA	NA	NA	2440	2040	2200	1960
59. North Washington St. (S.B. Roadway)/N.B. On-Ramp Ext.	NA	NA	NA	NA	NA	NA	2420	2380	2290	2670
60. Causeway St./N.B. On-Ramp	NA	NA	NA	NA	NA	NA	1860	2530	1980	2970

NA = Not Applicable for this Alternative.
NOTE: Intersection Volumes are Total Approach Volumes.



✱ Beyond Map Limits:

- L1N S.E. Expressway, Between Columbia On- and Southampton Off-Ramps.
- L1S S.E. Expressway Between Southampton On- and Columbia Off-Ramps.
- R1N Columbia Road Off-Ramp-Northbound
- R1S Columbia Road On-Ramp-Southbound
- (1) Columbia Circle
- (33) Bell Circle, Revere

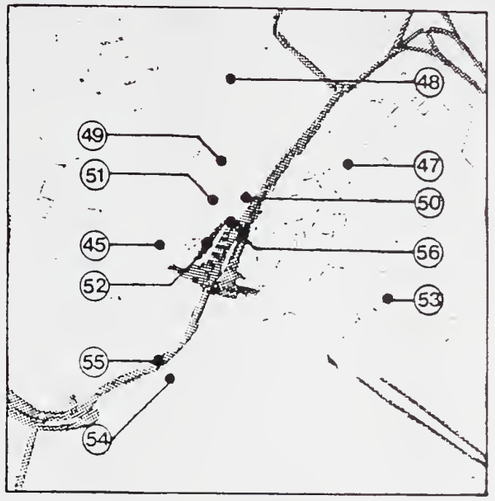


Figure 24
Affected Roadway Network – Roadway Link, Ramp, and Intersection Identification Map

0 450 900 1800 Feet

EIS/EIR for I-90–Third Harbor Tunnel: I-93–Central Artery

Legend

- (1) Existing Intersection
- L1N Existing Roadway Link or Ramp
- Affected Roadway Network

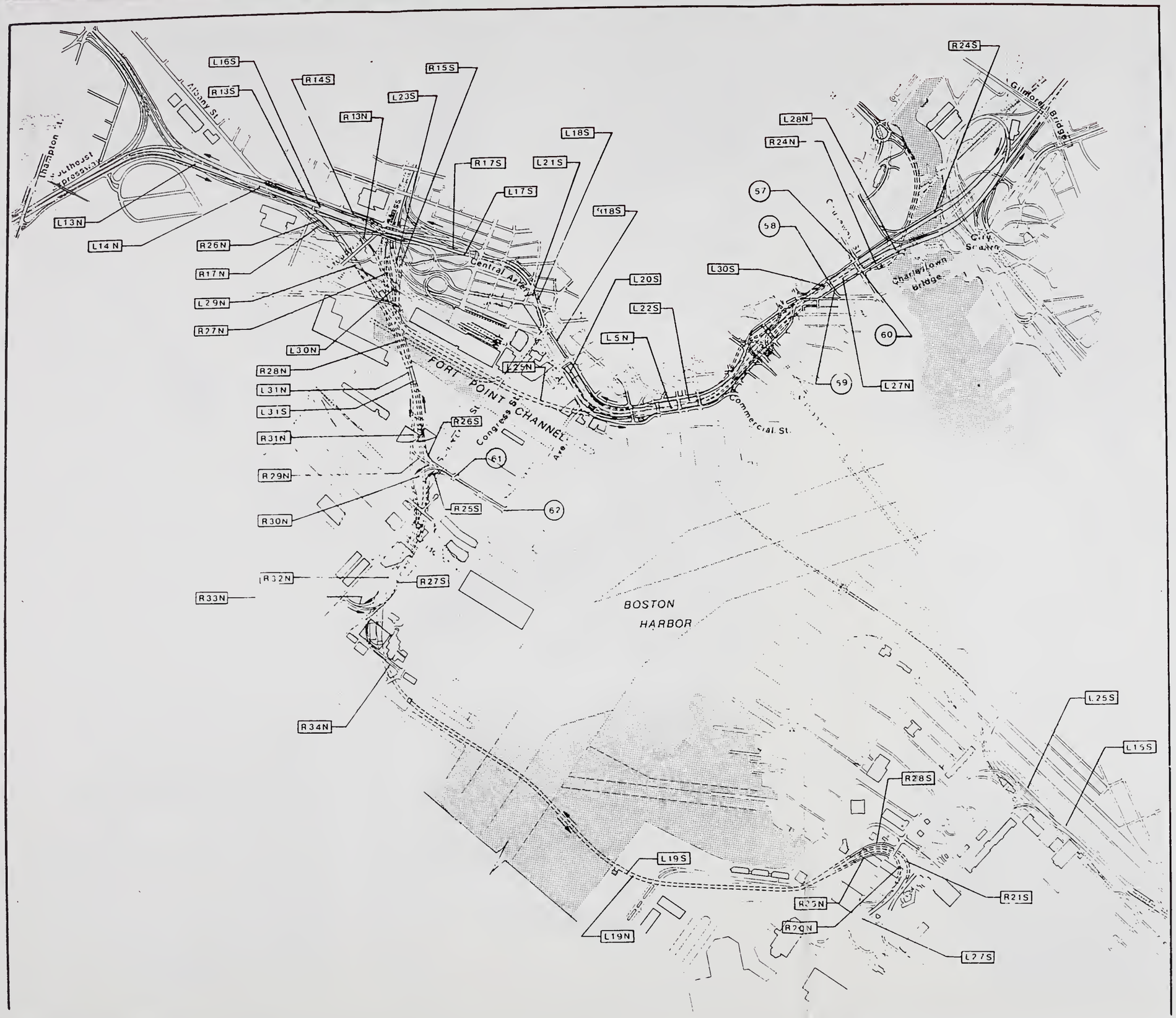


Figure 25
Two–Lane Tunnel Concept–
Affected Roadway Network–
Roadway Link, Ramp, and
Intersection Identification Map

0 750 1500 Feet

EIS/EIR for I-90 –Third Harbor Tunnel: I-93 – Central Artery

Legend

(1) Existing Intersection

L1N Existing Roadway Link or Ramp

peak hour (AM or PM).

In effect, it is expected that with the No-Build Alternative, peak period congestion will also spread substantially. The end result of this spreading of congestion may be a peak hour which is closer to 34 percent of the 3-hour peak period traffic volumes (the computer-assigned traffic forecast time periods from which AM and PM peak hour traffic volumes were derived) rather than the 37-38 percent of the 3-hour peak period volumes assumed for this analysis. This means the results of the analysis which follows are on the conservative or high side.

The Two-Lane Tunnel Concept generally would reduce traffic volumes in both 2010 peak hours on the existing cross-harbor highways compared to the No-Build Alternative, while increasing traffic volumes on the Central Artery. The most significant variations in traffic patterns follow:

- Callahan Tunnel: 23 percent decrease;
- Sumner Tunnel: 15 percent decrease;
- Mystic-Tobin Bridge: 6 percent decrease, and;
- Central Artery south of the Existing Tunnels (north of Northern Avenue): 19 percent increase.

Local Streets/Intersections Peak Hour Traffic

South Boston Peak Hours. In South Boston, peak hour traffic volume increases without the project will be most significant at Andrew Square during both peak hours, and at the intersections of Dorchester Avenue with Summer and Congress Streets during the PM peak hour. At Andrew Square, this indicates that traffic will continue to bypass Southeast Expressway/Central Artery congestion by using Dorchester Avenue in South Boston. At the intersections of Dorchester Avenue with Summer and Congress Streets, increased traffic will accompany the future new development in South Boston's northern industrial sector. Increases of 20 to 35 percent during both peak hours will also occur at the Herald Street/ Broadway/ Albany Street/ Frontage Road and the Berkeley Street/ West Fourth Street/ Albany Street/ Frontage Road intersections without the project between 1982 and 2010.

With the No-Build Alternative, the current high peak hour (and off-peak) truck volumes on residential streets in South Boston will grow considerably due to future development in South Boston's northern industrial area. The June 1980 feasibility study entitled "Preliminary Environmental Assessment Seaport Access System South Boston, Massachusetts" identified, in detail, the magnitude of the problem of local street truck traffic. Survey data collected in December 1976, indicated that the northern industrial area of South Boston (east of the Fort Point Channel, north of Broadway and southwest of First Street) accounted for 7,100 of 9,400 daily truck trips that had origins and destinations in South Boston. In addition, another 1,000 trucks per day travel through South Boston between other destinations. The Seaport Access Connector, as described in the report and assumed with the No-Build Alternative, would provide an alternative route for trucks travelling through South Boston to and from points to the south. The study showed that a Seaport Access Connector was capable of diverting 18 percent of all trucks coming to and from the northern industrial area. A large volume of trucks which would use the West Fourth Street and Broadway Bridges to go to the northern industrial area would not be affected by the Seaport Access Connector.

Compared to the No-Build Alternative, with the exception of Congress Street and Northern Avenue, peak hour volumes on South Boston streets in 2010 would either stay the

same or decrease with the Two-Lane Tunnel Concept. For example, volumes on Dorchester Avenue would generally be lower than No-Build Alternative volumes south of West Fourth Street and the Fort Point Channel. Both A and D Streets would have lower peak hour volumes than the No-Build with the Two-Lane Tunnel Concept. Peak hour L Street traffic would be expected to be about the same as with the No-Build Alternative.

East Boston Peak Hours. In East Boston, peak hour traffic without the project will increase by 60 to 80 percent between 1982 and 2010 at the Airport Cross Road intersection due to future Airport development. Traffic on other streets in East Boston is also expected to grow substantially. Peak hour traffic volumes at Bell Circle in Revere will increase by 20 to 25 percent between 1982 and 2010 with the No-Build Alternative.

With the Two-Lane Tunnel Concept, due to the presence of a Third Harbor Tunnel, minor decreases in AM and PM peak hour traffic would occur on a few of the selected local streets in East Boston. Porter Street (which would be expected to carry high volumes of airport-related traffic diverting off Route 1A with the No-Build Alternative) particularly benefits from the presence of a Third Harbor Tunnel, even with the reduced capacity of a two-lane vs. a four-lane tunnel. However, traffic through Bell Circle would be five percent greater than with the No-Build Alternative.

Downtown Boston Peak Hours. Substantial increases in AM and PM peak hour traffic will occur at several downtown intersections without the project between 1982 and 2010, especially at some intersections along Atlantic Avenue. Between 1982 and 2010, peak hour traffic is expected to increase by 24 percent in the AM peak hour and by 44 percent in the PM peak hour.

Generally, in downtown Boston, overall peak hour traffic volumes with the Two-Lane Tunnel Concept are expected to be slightly lower when compared to the No-Build Alternative. As indicated in Table 12, the Two-Lane Tunnel Concept would generally reduce downtown Boston local street traffic by diverting through traffic from local streets and the Surface Artery back to the Central Artery -- where congestion is less than that found with the No-Build Alternative.

At Leverett Circle, peak hour traffic volumes in the Charles River Dam area will increase with the No-Build Alternative, causing even longer back-ups in peak hours than presently occur. Peak hour volumes and congestion at Leverett Circle would be reduced with the Two-Lane Tunnel Concept.

3.1.3 V/C Ratios and Levels of Service

Volume/capacity (v/c) ratios, operating speeds, and levels of service (LOS) for both the No-Build Alternative and the Two-Lane Tunnel Concept during the AM and PM peak hours in 1982, 1990, and 2010 are summarized in Table 13 for the selected major highway link, ramp sections, and local intersections.

The computed levels of service during the AM and PM peak hours for selected regional highway links, ramps, and intersections have been tabulated for the No-Build Alternative and the Two-Lane Tunnel Concept. This was done to offer an overview of total regional highway network impacts of the Two-Lane Tunnel Concept, which are summarized in Table 14. For the purpose of this study, three classes of level of service were evaluated as follows:

1. A-D: Acceptable operating conditions in densely developed urban conditions such as those found in the project area.

2. E: Unacceptable highly congested operating conditions, as traffic volumes are equal to, or below, capacity, and speeds are slow but moving.

Table 13
PEAK HOUR VOLUME - TO - CAPACITY RATIO (V/C)
OPERATING SPEED (SP) AND LEVEL OF SERVICE (LOS)
1982, 1990 AND 2010

	EXISTING						NO-BUILD ALTERNATIVE												TWO-LANE TUNNEL											
	1982						1990						2010						1990						2010					
	AM			PM			AM			PM			AM			PM			AM			PM			AM			PM		
MAJOR HIGHWAY LINKS - NORTHBOUND	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	1.03	30	F	0.60	40	C	1.22	25	F	0.83	35	E	1.34	20	F	0.91	35	E	1.29	20	F	0.86	20	F	1.37	20	F	0.93	20	F
L2N. Frontage Road: Adjacent to Mass. Ave. Interchange	0.69	30	D	0.46	40	B	0.74	25	D	0.44	40	B	0.76	25	D	0.42	40	B	0.68	25	D	0.36	40	B	0.73	25	D	0.38	40	B
L13N. S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA			NA			NA			NA			NA			NA			1.18	25	F	0.81	40	D	1.34	25	F	0.88	35	E
L14N. S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA			NA			NA			NA			NA			NA			1.04	25	F	0.72	40	D	1.18	25	F	0.78	35	E
L16N. Fort Point Channel Tunnel: Before Merge with Central Artery Roadway	NA			NA			NA			NA			NA			NA			0.35	40	C	0.54	40	C	0.35	40	C	0.62	40	C
L19N. Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.66	40	C	0.80	40	C	0.82	40	C	1.11	20	F
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	1.10	30	F	0.75	30	F	1.10	30	F	0.81	30	F	1.31	20	F	0.88	25	F	NA			NA			NA			NA		
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	1.13	20	F	0.75	15	F	1.29	15	F	1.01	15	F	1.62	10	F	1.00	15	F	NA			NA			NA			NA		
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	0.96	30	F	0.78	15	F	1.06	25	F	1.06	15	F	1.19	20	F	1.11	15	F	0.91	20	F	0.94	20	F	1.10	20	F	0.94	20	F
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	0.90	35	E	0.79	15	F	1.06	25	F	0.99	15	F	1.24	20	F	1.00	15	F	NA			NA			NA			NA		
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	0.89	25	F	1.30	15	F	0.68	40	C	1.46	15	F	0.91	30	C	1.50	15	F	0.61	40	C	0.69	40	C	0.72	40	C	0.61	40	C
L8N. Mystic Tobin Bridge: North of I-93 Ramps	0.40	50	A	0.78	45	C	0.48	45	A	0.85	40	D	0.50	45	A	0.90	35	E	0.35	50	A	0.61	45	B	0.37	50	A	0.63	45	B
L9N. I-93: North of Tobin Bridge Ramps	0.28	50	A	0.59	50	C	0.31	50	A	0.59	50	C	0.38	50	A	0.61	50	C	0.32	50	A	0.42	45	B	0.40	50	A	0.62	45	B
L10N. Callahan Tunnel	0.85	35	D	1.06	20	F	0.99	30	E	1.39	20	F	1.17	20	F	1.51	15	F	0.68	35	C	1.00	20	F	0.87	35	C	1.06	20	F
L25N. Central Artery Tunnel: Before Atlantic Ave. On-Ramp	NA			NA			NA			NA			NA			NA			0.82	20	F	0.70	20	F	1.00	20	F	0.74	20	F
L27N. Central Artery: Btwn. Sumner On- and Storrow Off-Ramps	NA			NA			NA			NA			NA			NA			0.66	40	C	0.67	20	F	0.85	20	F	0.69	20	F
L28N. Central Artery: Btwn. Causeway On- and Storrow On-Ramps	NA			NA			NA			NA			NA			NA			0.56	40	C	0.60	40	C	0.64	40	C	0.51	40	C
L29N. Central Artery Tunnel: Btwn. Frontage On- and Connector CN-AT	NA			NA			NA			NA			NA			NA			0.84	25	F	0.63	25	F	0.97	20	F	0.68	25	F
L30N. Connector: Mass. Turnpike to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.88	40	C	0.32	40	C	0.90	30	E	0.40	40	C
L31N. Third Harbor Tunnel: Btwn. Connector CN-AT and Congress Off-Ramp	NA			NA			NA			NA			NA			NA			0.58	40	C	0.34	35	D	0.66	40	C	0.44	30	E
L11N. Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	0.36	35	C	0.45	30	C	0.44	30	C	0.58	20	C	0.51	25	C	0.63	20	C	0.36	40	C	0.51	40	C	0.41	40	C	0.54	40	C
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	0.17	45	A	0.39	40	B	0.22	45	A	0.43	40	B	0.24	45	A	0.47	35	C	0.24	45	A	0.46	40	B	0.26	45	A	0.52	35	C
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND																														
L1E. Mass. Turnpike, Eastbound; West of Expressway Ramps	0.80	40	D	0.37	45	C	0.87	30	E	0.45	45	C	0.88	30	E	0.52	45	C	0.87	30	E	0.49	45	C	0.92	30	E	0.56	45	C
L1W. Mass. Turnpike, Westbound; West of Expressway Ramps	0.27	55	A	0.58	55	B	0.46	55	B	0.62	55	B	0.49	55	B	0.66	50	C	0.51	55	B	0.66	50	C	0.51	55	B	0.74	50	C
L2E. Storrow Drive, Eastbound; West of Copley Square Ramps	0.59	40	C	0.45	40	C	0.59	40	C	0.51	40	C	0.69	40	C	0.53	40	C	0.60	40	C	0.49	40	C	0.71	35	D	0.50	40	C
L2W. Storrow Drive, Westbound; West of Copley Square Ramps	0.42	40	C	0.59	40	C	0.57	40	C	0.68	40	C	0.67	40	C	0.69	40	C	0.52	40	C	0.64	40	C	0.71	35	D	0.67	40	C
MAJOR HIGHWAY LINKS - SOUTHBOUND																														
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	0.62	50	B	0.74	30	F	0.71	40	D	1.15	30	F	0.78	40	D	1.22	30	F	0.73	40	D	1.20	30	F	0.80	40	D	1.27	30	F
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	0.62	50	A	0.85	30	E	0.64	40	D	1.21	25	F	0.70	30	F	1.35	20	F	0.67	40	D	1.13	25	F	0.73	30	F	1.17	25	F
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	0.73	35	D	0.95	20	F	0.60	45	B	1.13	20	F	0.63	40	C	1.17	20	F	0.72	40	C	1.24	20	F	0.74	40	C	1.30	20	F
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	0.74	40	C	0.72	20	F	0.78	25	F	1.13	20	F	0.85	25	F	1.16	20	F	NA			NA			NA			NA		
L16S. Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA			NA			NA			NA			NA			NA			0.70	45	C	1.06	30	F	0.71	45	C	1.13	30	F
L17S. Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA			NA			NA			NA			NA			NA			0.50	45	C	0.71	45	C	0.51	45	C	0.77	35	D
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	0.78	35	E	0.75	20	F	0.90	25	F	1.10	15	F	0.91	20	F	1.12	15	F	NA			NA			NA			NA		
L18S. Central Artery Local Rdwy: Btwn. Purchase On - and Beach Off-Ramps	NA			NA			NA			NA			NA			NA			0.43	35	E	0.60	40	D	0.45	35	E	0.68	30	F
L19S. Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.42	40	C	0.67	40	C	0.49	40	C	0.92	35	D
L20S. Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA			NA			NA			NA			NA			NA			0.47	40	C	0.43	40	C	0.50	40	C	0.50	40	C
L21S. Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA			NA			NA			NA			NA			NA			0.51	40	C	0.54	40	C	0.53	40	C	0.51	40	C
L6S. Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	0.83	30	E	0.65	25	F	0.92	25	F	1.02	20	F	0.97	20	F	1.05	20	F	NA			NA			NA			NA		
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	1.08	30	F	0.64	25	F	1.05	25	F	0.94	25	F	1.14	20	F	0.98	25	F	NA			NA			NA			NA		
L22S. Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA			NA			NA			NA			NA			NA			0.89	35	D	0.77	35	D	0.90	30	E	0.79	35	D
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	0.96	30	F	0.62	25	F	0.95	25	F	0.91	25	F	1.03	20	F	0.94	25	F	NA			NA			NA			NA		
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	0.96	30	E	0.51	25	F	0.96	25	E	0.77	25	F	1.14	20	F	0.77	25	F	NA			NA			NA			NA		
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	1.20	20	F	0.81	25	F	0.88	25	F	0.74	25	F	1.14	20	F	0.75	30	F	0.64	30	F	0.55	30	F	0.94	30	F	0.51	30	F
L11S. Mystic Tobin Bridge: North of I-93 Ramps	1.13	10	F	0.81	30	F	0.84	40	D	0.56	45	C	0.93	35	E	0.62	45	C	0.61	45	B	0.38	50	A	0.66	40	C	0.41	45	B
L12S. I-93: North of Tobin Bridge Ramps	0.73	15	F	0.40	50	B	0.64	35	E	0.53	50	B	0.74	30	F	0.55	50	B	0.53	30	F	0.42	45	B	0.66	30	F	0.42	45	B
L13S. Sumner Tunnel	1.17	20	F	0.98	20	F	1.28	20	F	1.04	20	F	1.37	20	F	1.21	20	F	1.13	20	F	0.79	35	C	1.28	20	F	0.92	30	E
L30S. Central Artery: Btwn. Storrow On- and Callahan Off-Ramps	NA			NA			NA			NA			NA			NA			0.63	40	C	0.56	40	C	0.73	40	C	0.61	40	C
L23S. Fort Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA			NA			NA			NA			NA			NA			0.17	40	C	0.41	40	C	0.21	40	C	0.42	40	C
L31S. Third Harbor Tunnel: Btwn. Congress On- and Mass. Tpk. Off-Ramps	NA			NA			NA			NA			NA			NA			0.18	40	C	0.38	40	C	0.22	40	C	0.45	40	C
L14S. Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	0.27	5	F	0.34	5	F	0.30	5	F	0.31	5	F	0.31	5	F	0.36	5	F	0.26	40	C	0.27	40	C	0.27	40	C	0.31	40	C
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	0.31	45	A	0.28	45	A	0.26	45	A	0.18	45	A	0.26	45	A	0.20	45	A	0.27	40	C	0.20	40	C	0.30	40	C	0.23	40	C
L27S. Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA			NA			NA			NA			NA			NA			0.32	40	C	0.34	40	C	0.64	40	C	0.40	40	C

NA = Not Applicable for

Table 13 (cont.)
PEAK HOUR VOLUME - TO - CAPACITY RATIO (V/C)
OPERATING SPEED (SP) AND LEVEL OF SERVICE (LOS)
1982, 1990 AND 2010

	EXISTING						NO-BUILD ALTERNATIVE												TWO-LANE TUNNEL											
	1982						1990						2010						1990						2010					
	AM			PM			AM			PM			AM			PM			AM			PM			AM			PM		
MAJOR HIGHWAY RAMPS - NORTHBOUND	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS
R1N. Columbia Rd. Off; from S.E. Expressway	0.34	35	C	0.17	35	C	0.38	35	C	0.20	35	C	0.46	35	C	0.22	35	C	0.38	35	C	0.10	35	C	0.46	35	C	0.10	35	C
2N. Mass. Avenue On; to S.E. Expressway	0.30	30	F	0.13	40	B	0.99	30	F	0.46	30	F	1.31	30	F	0.46	30	F	0.89	30	F	0.55	35	E	1.34	30	F	0.58	30	F
13N. Ramp: Frontage Rd. to Fort Point Channel Tunnel	NA			NA			NA			NA			NA			NA			0.23	30	C	0.54	30	C	0.23	30	C	0.64	30	C
R3N. Mass. Tpk. On; to Central Artery	1.08	20	F	0.51	30	C	1.17	20	F	0.51	30	C	1.56	10	F	0.51	30	C	NA			NA			NA			NA		
R4N. Atlantic Ave. Off; from Central Artery	1.58	15	F	1.03	20	F	>2.00	10	F	1.40	15	F	>2.00	5	F	1.40	15	F	NA			NA			NA			NA		
5N. Atlantic Ave. On; to Central Artery	0.16	25	F	0.53	15	F	0.61	25	F	0.66	15	F	0.61	20	F	0.76	15	F	0.87	25	F	1.45	10	F	0.95	20	F	1.45	10	F
6N. Callahan Tunnel Off; from Central Artery	0.86	25	F	0.47	20	F	0.81	25	E	0.90	20	F	0.86	20	F	0.99	15	F	NA			NA			NA			NA		
R7N. Sumner Tunnel On; to Central Artery	0.91	30	E	0.87	30	E	1.00	15	F	0.98	15	F	1.37	10	F	0.98	15	F	0.70	30	E	0.60	15	F	1.21	10	F	0.71	15	F
8N. Storrow Drive Off; from Central Artery	0.62	35	C	0.37	40	C	0.59	35	C	0.55	40	C	0.80	25	E	0.56	40	C	1.17	20	F	1.47	15	F	1.84	10	F	1.72	10	F
9N. Storrow Drive On; to Central Artery	0.78	30	E	1.37	10	F	0.78	30	E	1.54	10	F	0.91	30	E	1.58	10	F	0.42	30	C	0.81	25	E	0.62	30	C	0.81	25	E
R23N. Callahan Tunnel/Cross St. Off; from Central Artery	NA			NA			NA			NA			NA			NA			1.84	5	F	1.77	5	F	>2.00	5	F	1.94	5	F
R24N. Causeway St. On; to Central Artery	NA			NA			NA			NA			NA			NA			0.36	30	C	0.75	20	E	0.54	30	C	0.75	20	E
17N. Connector: Central Artery to Mass. Tpk./Kneeland St.	NA			NA			NA			NA			NA			NA			0.81	25	E	0.62	40	C	0.84	25	E	0.67	40	C
26N. W. Fourth St. On; to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.34	25	F	0.58	25	F	0.44	25	F	0.60	25	F
R27N. Mass. Turnpike On; to Fort Point Channel Tunnel	NA			NA			NA			NA			NA			NA			0.20	50	A	0.15	45	B	0.28	50	A	0.15	40	C
R28N. Connector: Central Artery to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.47	45	B	0.29	50	A	0.47	45	B	0.37	45	B
31N. Ramp: Third Harbor Tunnel to Congress St./S. Boston Access Rd.	NA			NA			NA			NA			NA			NA			0.62	35	C	0.15	50	A	0.67	35	C	0.17	50	A
29N. Congress St. Off; from Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.99	25	E	0.17	30	C	1.03	20	F	0.17	30	C
R30N. Congress St. On; to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.05	30	C	0.05	30	C	0.07	30	C	0.09	20	E
32N. South Boston Access Road	NA			NA			NA			NA			NA			NA			0.42	40	B	0.17	50	A	0.48	40	B	0.20	50	A
33N. Ramp: South Boston Access Road to Summer St.	NA			NA			NA			NA			NA			NA			0.17	30	C	0.06	30	C	0.19	30	C	0.08	30	C
R34N. Ramp: South Boston Access Road to Northern Ave.	NA			NA			NA			NA			NA			NA			0.25	30	C	0.11	30	C	0.30	30	C	0.13	30	C
N. Airport Off; from Route 1A	0.87	30	E	0.79	30	E	1.07	25	F	1.14	25	F	1.33	20	F	1.30	20	F	0.71	30	C	0.78	25	E	0.88	25	E	0.85	25	E
N. Airport On; to Route 1A	0.17	40	B	0.57	40	B	0.28	40	B	0.59	35	C	0.36	40	B	0.76	30	D	0.29	40	B	0.59	35	C	0.36	40	B	0.76	25	E
20N. Ramp: Third Harbor Tunnel to Airport	NA			NA			NA			NA			NA			NA			0.62	30	C	0.72	25	D	0.77	25	E	0.98	25	E
R35N. Ramp: Third Harbor Tunnel to Bird Island Flats	NA			NA			NA			NA			NA			NA			0.05	35	C	0.07	35	C	0.05	35	C	0.12	35	C
MAJOR HIGHWAY RAMPS - SOUTHBOUND																														
1S. Columbia Rd. On; to S.E. Expressway	0.27	35	C	1.28	25	F	0.27	35	C	1.33	25	F	0.32	35	C	1.38	20	F	0.10	40	C	0.55	25	F	0.13	40	C	0.57	25	F
2S. Mass. Ave. Off; from S.E. Expressway	0.23	40	B	0.16	45	A	0.23	40	B	0.20	40	B	0.27	40	B	0.23	40	B	0.05	50	A	0.14	50	A	0.05	50	A	0.18	50	A
3S. Albany St. On; to S.E. Expressway	0.40	30	C	1.25	20	F	0.33	30	C	1.51	20	F	0.33	30	C	1.51	20	F	0.46	30	C	1.31	20	F	0.46	30	C	1.31	20	F
R13S. Ramp: Fort Point Channel Tunnel to S.E. Expressway	NA			NA			NA			NA			NA			NA			0.20	35	C	0.64	30	D	0.23	35	C	0.64	30	D
14S. Ramp: Fort Point Channel Tunnel to Albany St.	NA			NA			NA			NA			NA			NA			0.15	30	C	0.21	30	C	0.21	30	C	0.25	30	C
15S. Ramp: Fort Point Channel Tunnel to Mass. Tpk.	NA			NA			NA			NA			NA			NA			0.26	40	C	0.40	40	C	0.27	40	C	0.59	40	C
R4S. Mass. Tpk./Albany St. Off; from Central Artery	0.85	25	E	0.88	25	E	0.85	25	E	0.95	20	B	1.02	15	F	1.13	15	F	0.55	35	C	0.59	35	C	0.64	35	C	0.59	35	C
R17S. Ramp: Mass. Tpk./Kneeland St. to Central Artery	NA			NA			NA			NA			NA			NA			0.84	25	E	1.54	10	F	0.87	20	F	1.57	10	F
5S. Dewey Sq. Off; from Central Artery	0.50	30	C	0.32	30	C	0.49	30	C	0.34	30	C	0.56	30	C	0.34	30	C	0.49	30	C	0.39	30	C	0.50	30	C	0.39	30	C
6S. High St. Off; from Central Artery	0.87	20	E	0.36	30	C	0.74	20	E	0.36	30	C	0.89	20	E	0.36	30	C	NA			NA			NA			NA		
R18S. Purchase St. On; to Central Artery	NA			NA			NA			NA			NA			NA			0.59	20	E	1.32	10	F	0.66	20	E	1.39	10	F
19S. Ramp: Central Artery to Purchase St.	NA			NA			NA			NA			NA			NA			0.92	20	E	0.47	30	C	0.97	15	F	0.47	30	C
7S. Haymarket On; to Central Artery	1.01	15	F	1.20	15	F	1.13	15	F	1.12	15	F	1.32	10	F	1.12	15	F	NA			NA			NA			NA		
8S. Callahan Tunnel Off; from Central Artery	0.41	15	F	0.57	15	F	0.49	15	F	0.46	15	F	0.62	15	F	0.48	15	F	0.57	30	C	0.66	30	C	0.84	20	E	0.78	30	C
R9S. Storrow Drive On; to Central Artery	0.98	20	F	0.57	30	C	1.34	20	F	0.75	25	E	1.39	20	F	0.77	25	E	1.39	20	F	1.07	20	F	1.39	20	F	1.39	20	F
10S. Storrow Drive Off; from Central Artery	1.12	20	F	1.22	20	F	1.06	20	F	1.25	20	F	1.39	20	F	1.29	20	F	NA			NA			NA			NA		
23S. Haymarket/Sumner Tunnel On; to Central Artery	NA			NA			NA			NA			NA			NA			1.94	5	F	1.69	5	F	1.94	5	F	1.72	5	F
R24S. Storrow Drive/Causeway St. Off; from Central Artery	NA			NA			NA			NA			NA			NA			1.68	20	F	1.09	20	F	>2.00	15	F	1.09	20	F
R25S. Congress St. Off; from Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.05	25	D	0.13	25	D	0.07	25	D	0.21	25	D
26S. Congress St. On; to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.14	30	C	0.51	30	C	0.15	30	C	0.51	30	C
7S. Summer St./Northern Ave. on; To Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.15	30	C	0.27	30	C	0.17	30	C	0.31	30	C
1S. Airport Off; from Route 1A	0.47	35	B	0.33	40	A	0.54	30	C	0.42	35	B	0.63	30	C	0.53	30	C	0.54	30	C	0.42	30	C	0.59	30	C	0.53	30	C
12S. Airport On; to Route 1A	0.34	30	C	0.55	25	F	0.69	30	C	0.91	20	F	0.87	25	E	1.17	15	F	0.51	30	C	0.67	30	C	0.53	30	C	0.79	25	E
21S. Ramp: Airport to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.37	30	C	0.60	30	C	0.45	30	C	0.84	25	E
28S. Ramp: Bird Island Flats to Third Harbor Tunnel	NA			NA			NA			NA			NA			NA			0.05	30	C	0.07	30	C	0.05	30	C	0.10	30	C

NA = Not Applicable for this Alternative

INTERSECTIONS

South Boston

1. Columbia Circle
2. Andrew Square*
3. Columbia Rd./Day Blvd./L St.
4. L St./East First St./Summer St.*
5. Dorchester Ave./W. 5th St./A St.*
6. Dorchester Ave./W. 4th St.*
7. Dorchester Ave./W. Broadway*
8. Summer St./Dorchester Ave.*
9. Summer St./Melcher St.*
10. Summer St./D St.*
11. Congress St./Dorchester Ave.
12. Congress St./A St.
13. Northern Ave./Sleeper St.
14. Herald St./Broadway/Frontage Rd./Albany St.*
15. Berkeley St./W. Fourth St./Frontage Rd./Albany St.*
61. Congress St./Third Harbor Tunnel Ramps (Assumed *)
62. Northern Ave./Third Harbor Tunnel Ramps Ext. (Assumed *)
63. Northern Ave./Third Harbor Tunnel Ramps at General Ship (Assumed*)
64. Summer St./Third Harbor Tunnel Ramps (Assumed*)

East Boston and Revere

16. Sumner St./Meridian St./Chelsea St.*
17. Sumner St./Bremen St.
18. Maverick St./Meridian St./Chelsea St.
19. Maverick St./Bremen St.
20. Maverick St./Jeffries St./Airport Access Rd.
21. Porter St./Chelsea St./Visconti Rd.*
22. Porter St./Bremen St.
23. Porter St./Orleans St.
24. Porter St./Cottage St.
25. Central Square (Meridian St./Saratoga St.)*
26. Porter St./London St.
27. Bennington St./Prescott St.
28. Chelsea St./East Eagle St.
29. Bennington St./Neptune Rd.
30. McClellan Off-Ramp/Neptune Rd.
31. Condor St./Meridian St.*
32. Airport Crossover Roads*
33. Bell Circle (Revere)*

Downtown Boston and Charlestown

34. Kneeland St./Surface Artery/S.B. On-Ramp*
35. Dewey Sq.*
36. Atlantic Ave./Congress St.*
37. Atlantic Ave./Northern Ave.*
38. Atlantic Ave./Surface Artery/High St.*
39. Purchase St./Congress St.*
40. North St./Blackstone St./S.B. Off-Ramp (Assumed *)
41. Cross St./Hanover St./Salem St. (Assumed *)
42. Leverett Circle*
45. Congress St./North St.*
46. City Square (Charlestown)*
47. Causeway St./North Washington St./Commercial St.*
48. Causeway St./Lomasney Way/Merrimac St./Staniford St. (Assumed *)
49. New Chardon St./Merrimac St.*
50. New Chardon St./North Washington St.*
51. Sudbury St./Congress St./Merrimac St.*
52. Surface Artery/Hanover St.
53. Commercial St./Hanover St.
54. State St./Atlantic Ave.*
55. State St./Surface Artery*
56. Sudbury St./Blackstone St./S.B. On-Ramp*
57. Causeway St./S.B. Off-Ramp (Assumed *)
58. North Washington St. (S.B. Roadway)/S.B. Off-Ramp Ext. (Assumed *)
59. North Washington St. (S.B. Roadway)/N.B. On-Ramp Ext. (Assumed *)
60. Causeway St./N.B. On-Ramp (Assumed *)

Table 13 (cont.)
PEAK HOUR VOLUME - TO - CAPACITY RATIO (V/C)
AND LEVEL OF SERVICE (LOS)
1982, 1990 AND 2010

EXISTING				NO-BUILD ALTERNATIVE								TWO-LANE TUNNEL							
1982				1990				2010				1990				2010			
AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
0.85	D	0.52	A	0.95	E	0.65	B	0.95	E	0.76	C	0.95	E	0.72	C	0.92	E	0.78	C
1.02	F	0.84	D	1.63	F	1.53	F	1.65	F	1.63	F	1.49	F	1.42	F	1.59	F	1.52	F
0.25	C	1.05	F	>2.00	F	1.27	F	>2.00	F	1.39	F	0.62	D	1.16	F	0.62	D	1.22	F
0.86	D	0.76	C	0.92	E	0.86	D	0.93	E	0.90	D	0.90	E	0.86	D	0.96	E	0.91	E
0.53	A	0.65	B	0.55	A	0.69	B	0.56	A	0.81	D	0.60	B	0.67	B	0.63	B	0.71	C
0.58	A	0.50	A	0.50	A	0.52	A	0.52	A	0.58	A	0.57	A	0.56	A	0.59	A	0.63	B
0.87	D	1.07	F	0.92	E	0.86	D	0.96	E	0.95	E	0.82	D	1.03	E	0.98	E	1.06	F
0.78	C	0.76	C	0.99	E	1.46	F	0.99	E	1.44	F	1.00	E	1.32	F	1.05	F	1.33	F
0.44	A	0.48	A	0.53	A	0.69	B	0.53	A	0.67	B	0.62	B	0.69	B	0.62	B	0.72	C
0.73	C	0.69	B	0.78	C	0.75	C	0.60	C	0.76	C	0.70	B	0.72	C	0.72	C	0.75	C
>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F
0.88	E	1.25	F	1.47	F	>2.00	F	1.47	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F
1.30	F	>2.00	F	>2.00	F	>2.00	F	1.91	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F
0.84	D	0.80	C	1.07	F	0.90	E	1.13	F	0.94	E	0.91	E	0.91	E	0.98	E	1.00	E
1.03	F	0.76	C	1.07	F	0.77	C	1.11	F	0.80	C	1.22	F	1.02	F	1.23	F	1.02	F
NA		NA		NA		NA		NA		NA		0.62	B	0.43	A	0.84	D	0.48	A
NA		NA		NA		NA		NA		NA		0.44	A	0.47	A	0.44	A	0.51	A
NA		NA		NA		NA		NA		NA		0.60	A	0.52	A	0.69	B	0.59	A
NA		NA		NA		NA		NA		NA		0.52	A	0.43	A	0.54	A	0.45	A
0.26	A	0.34	A	0.44	A	0.46	A	0.44	A	0.46	A	0.34	A	0.44	A	0.34	A	0.44	A
0.08	B	0.12	B	0.22	B	0.12	B	0.14	B	0.12	B	0.15	A	0.12	B	0.16	A	0.12	B
0.52	C	0.44	B	0.52	C	0.63	D	0.51	C	0.69	D	0.50	B	0.63	D	0.51	B	0.69	D
0.21	A	0.15	A	0.20	A	0.17	B	0.20	A	0.17	B	0.21	A	0.16	B	0.21	A	0.16	B
0.26	A	0.15	A	0.26	A	0.14	A	0.26	A	0.14	A	0.26	A	0.14	A	0.27	A	0.15	A
0.83	D	0.65	B	0.93	E	0.88	D	1.27	F	1.01	F	0.91	E	0.69	B	1.00	F	0.79	C
0.52	D	0.75	E	0.94	E	0.73	E	1.09	F	1.04	F	0.67	E	0.59	E	1.02	F	0.80	E
0.11	A	0.22	C	0.27	D	0.20	D	0.27	D	0.28	D	0.16	B	0.18	C	0.19	C	0.23	C
0.34	A	0.32	A	0.49	A	0.52	A	0.64	B	0.62	B	0.43	A	0.46	A	0.57	A	0.54	A
0.42	A	0.36	A	0.46	A	0.44	A	0.57	A	0.54	A	0.46	A	0.40	A	0.53	A	0.40	A
1.05	F	0.37	C	1.22	F	0.60	D	1.30	F	0.99	E	0.86	E	0.45	D	1.14	F	0.63	E
0.23	D	0.14	D			NO DATA AVAILABLE								NO DATA AVAILABLE					
0.18	C	0.26	C	0.22	D	0.12	A	0.28	D	0.14	A	0.22	C	0.24	C	0.22	C	0.30	D
0.68	B	0.62	B			NO DATA AVAILABLE								NO DATA AVAILABLE					
0.55	C	1.27	F	0.38	C	1.04	F	0.56	D	0.96	F	0.58	D	0.98	E	0.74	E	1.25	F
0.50	A	0.63	B	0.60	A	0.71	C	0.69	B	0.78	C	0.53	A	0.67	B	0.62	B	0.73	C
0.64	B	0.95	E	0.77	C	0.81	D	0.94	E	0.99	E	0.62	B	0.66	B	0.75	C	0.83	D
1.15	F	0.89	D	1.33	F	1.20	F	1.37	F	1.24	F	1.40	F	1.26	F	1.05	F	1.41	F
0.69	B	0.86	D	1.04	F	0.71	C	0.97	F	0.90	E	0.73	C	0.92	E	0.63	C	0.95	E
0.57	F	0.73	F	>2.00	F	1.34	F	1.73	F	1.77	F	1.49	F	1.32	F	1.48	F	1.35	F
0.94	E	0.84	D	1.54	F	1.24	F	1.36	F	1.33	F	1.28	F	1.16	F	1.27	F	1.23	F
>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	1.25	F	1.30	F	1.13	F	1.31	F
0.89	D	0.80	C	1.42	F	0.93	F	1.42	F	0.81	F	0.77	C	0.67	B	0.64	C	0.75	C
0.65	B	0.82	D	0.64	B	0.72	C	0.68	B	0.77	D	0.79	C	1.05	F	0.86	D	1.13	F
>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	0.80	D	0.60	B	0.98	E	0.61	B
1.89	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	0.62	B	0.48	A	0.79	C	0.54	A
0.96	E	0.75	C	1.09	F	0.92	E	0.99	F	0.80	E	1.06	F	0.92	E	0.94	F	1.02	F
0.54	A	0.71	C	0.68	B	0.85	D	0.89	D	0.70	D	0.92	E	0.61	B	1.27	F	0.65	B
0.81	D	1.20	F	1.08	F	1.26	F	1.06	F	1.28	F	1.14	F	1.18	F	1.14	F	1.25	F
0.77	C	1.00	E	1.12	F	1.37	F	1.01	F	1.43	F	0.84	D	0.78	C	0.72	D	1.23	F
>2.00	F	>2.00	F	0.81	D	0.91	E	0.76	D	0.85	E	0.99	E	0.81	D	1.09	F	0.76	D
0.65	B	0.44	A	0.65	B	0.44	A	0.65	B	0.63	B	0.58	A	0.39	A	0.81	D	0.41	A
0.82	D	0.58	F	0.88	D	0.69	F	0.82	D	0.71	F	1.74	F	1.82	F	1.55	F	1.88	F
0.29	A	0.54	F	0.52	A	0.57	F	0.49	A	0.60	F	0.62	B	0.94	E	0.84	D	0.93	E
NA		NA		NA		NA		NA		NA		>2.00	F	>2.00	F	>2.00	F	>2.00	F
0.63	E	0.53	E	0.93	E	0.20	C	0.51	E	0.40	C	0.22	C	0.09	A	0.14	C	0.21	D
0.39	A	0.47	A	0.74	C	0.71	C	0.65	C	0.68	C	0.47	A	0.48	A	0.44	A	0.53	A
0.51	A	0.67	B	0.99	E	0.85	D	0.71	E	0.91	E	0.61	B	0.39	A	0.57	B	0.44	A
0.75	C	0.26	F	0.85	D	0.40	F	0.85	D	0.45	F	1.29	F	1.29	F	1.20	F	1.28	F
NA		NA		NA		NA		NA		NA		0.88	D	0.81	D	1.10	F	0.80	D
NA		NA		NA		NA		NA		NA		0.81	D	0.68	B	0.73	D	0.65	B
NA		NA		NA		NA		NA		NA		0.81	D	0.79	C	0.76	D	0.89	D
NA		NA		NA		NA		NA		NA		0.53	A	0.92	E	0.68	B	1.17	F

NA = Not Applicable for this Alternative.

* = Signalized Intersections

NOTE: V/C ratios and levels of service at unsignalized intersections indicate minor street operating conditions.

Table 14

LEVEL OF SERVICE TOTALS
REGIONAL HIGHWAY NETWORK[1]

AM PEAK

Level of Service	1982 EXISTING		1990 NO BUILD		1990 Two-Lane Tunnel Exist. Rdwys.		1990 Two-Lane Tunnel Proj. Rdwys.	
A-D	24	(44)	23	(42)	28	(72)	35	(72)
E	9	(17)	8	(15)	2	(5)	6	(12)
F	21	(39)	23	(43)	9	(23)	8	(16)
TOTAL	54	(100)	54	(100)	39	(100)	49	(100)

PM PEAK

Level of Service	1982 EXISTING		1990 NO BUILD		1990 Two-Lane Tunnel Exist. Rdwys.		1990 Two-Lane Tunnel Proj. Rdwys.	
A-D	22	(41)	21	(39)	23	(59)	38	(78)
E	4	(7)	2	(4)	3	(8)	1	(2)
F	28	(52)	31	(57)	13	(33)	10	(20)
TOTAL	54	(100)	54	(100)	39	(100)	49	(100)

AM PEAK

Level of Service	1982 EXISTING		2010 NO BUILD		2010 Two-Lane Tunnel Exist. Rdwys.		2010 Two-Lane Tunnel Proj. Rdwys.	
A-D	24	(44)	19	(35)	25	(64)	31	(63)
E	9	(17)	6	(11)	3	(8)	6	(12)
F	21	(39)	29	(54)	11	(28)	12	(25)
TOTAL	54	(100)	54	(100)	39	(100)	49	(100)

PM PEAK

Level of Service	1982 EXISTING		2010 NO BUILD		2010 Two-Lane Tunnel Exist. Rdwys.		2010 Two-Lane Tunnel Proj. Rdwys.	
A-D	22	(41)	19	(35)	20	(52)	30	(61)
E	4	(7)	3	(6)	5	(13)	7	(14)
F	28	(52)	32	(59)	14	(35)	12	(25)
TOTAL	54	(100)	54	(100)	39	(100)	49	(100)

[1] Number and percentage (in parenthesis) of selected roadway link and ramp sections which fall into the Level of Service category(s) indicated.

3. F: Intolerable, forced-flow conditions, as traffic operations break down causing stop-and-go traffic; demand volume exceeds capacity.

The degree to which the Two-Lane Tunnel Concept would minimize overall network LOS E to F operations and achieve LOS A-D operating conditions is a key traffic measure of effectiveness.

Major Highway Links V/C's and LOS

Table 15 summarizes the level of service computations for individual highway links and ramps contained in Table 13 to permit a more simplified analysis of the critical regional highway links affected by the Two-Lane Tunnel Concept.

As summarized in Table 15, without the proposed project, 2010 AM and PM peak hour levels of service and v/c's will remain the same or degrade further on the selected highway links, as traffic increases. The one exception will be the Mystic-Tobin Bridge. Its AM peak hour level of service will improve from LOS F to E due to the MDPW's Central Artery North Area Project. With the No-Build Alternative, both the Callahan and Sumner Tunnels will operate at LOS F during the AM and PM peak hours.

Generally, while the Two-Lane Tunnel Concept does not reduce the peak hour levels of service on most major routes, the duration of the congestion would be expected to be reduced substantially compared to the No-Build Alternative.

The Two-Lane Tunnel Concept would improve traffic operations in the Callahan Tunnel to LOS C during the morning peak hour and the Sumner Tunnel to LOS E during the PM peak hour. Otherwise, LOS F would prevail in both existing tunnels during the peak hours.

Compared to the No-Build Alternative (except for I-93 in the morning peak hour), the Two-Lane Tunnel Concept would improve year 2010 traffic operations -- i.e., LOS and v/c's -- on both I-93 and the Mystic-Tobin Bridge during the AM and PM peak hours.

On the Central Artery/Southeast Expressway, in both the 2010 AM and PM peak hours, LOS E or F conditions will prevail with the No-Build Alternative and the Two-Lane Tunnel Concept.

As an indication of the increased congestion expected on the major study area highways, an estimate of the number of congested hours of operation (LOS E or F) has been made for the No-Build Alternative in 2010 and is presented in Table 16; also presented in Table 16 are similar estimates for the Two-Lane Tunnel Concept. With the exception of the Southeast Expressway (which is not being improved under this project), in 2010, the Two-Lane Tunnel Concept substantially reduces the hours of congested operations on most of the major highway links and ramps in the project area.

In the Third Harbor Tunnel, with the Two-Lane Tunnel Concept, it is estimated that congestion would prevail in the northbound direction for at least three hours of the day. In the southbound direction, congestion would occur for at least one hour on a typical weekday.

South Boston Intersections V/C's and LOS

Levels of service calculated for the study area intersections in South Boston are summarized in Table 17. This tabulation was prepared from Table 13.

Without the project, South Boston intersections as a whole will suffer degradation in level of service and v/c's between 1982 and 2010 during both peaks. Several intersections paralleling the Southeast Expressway will carry "short-cutting" peak period traffic trying to avoid congestion on the Expressway/Artery by diverting to local streets.

Table 15

LEVEL OF SERVICE SUMMARY
BUILD VS. NO-BUILD ALTERNATIVES

	1982		2010			
	Existing		No-Build Alt		Two-Lane Tunnel	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Selected Highway Links Directional Level of Service - Worst Case						
Interstate Route 93	F	C	F	C	F	B
Mystic-Tobin Bridge	F	C	E	E	C	B
Storrow Drive, W. of Copley Sq.	C	C	C	C	D	C
Central Artery, No. of Tunnels	E-F	E-F	E-F	E-F	F	F
Callahan Tunnel	D	F	F	F	C	F
Sumner Tunnel	E	F	F	F	F	E
Central Artery, So. of Tunnels	E-F	F	F	F	F	F
Third Harbor Tunnel	-	-	-	-	C	F
Massachusetts Turnpike	D	B	E	C	E	C
Southeast Expressway	F	E-F	F	F	F	F
Route 1A, No. of Airport	A	A	A	A-B	C	C
Selected Highway Ramps						
Atlantic Ave. On-Ramp to Central Artery NB	F	F	F	F	F	F
Callahan Tunnel Off-Ramp from Central Artery NB	F	F	F	F	F*	F*
Storrow Drive Off-Ramp from Central Artery NB	C	C	E	C	F	F
Storrow Drive Off-Ramp from Central Artery SB	F	F	F	F	F**	F**
Callahan Tunnel Off-Ramp from Central Artery SB	F	F	F	F	E	C

* Ramp to Callahan Tunnel and Surface Artery.
** Ramp to Storrow Drive and Causeway Street.

Table 16

NUMBER OF HOURS OF CONGESTED OPERATION[1]

ROADWAY	Existing 1982	YEAR 2010 CONGESTED HOURS[1] NO-BUILD	2-Lane Tunnel Concept
Sumner Tunnel	5	14	5
Callahan Tunnel	5	14	3
Third Harbor Tunnel (Inbnd)	-	NA	1
Third Harbor Tunnel (Outbnd)	-	NA	3
Mystic-Tobin Bridge (Inbnd)	1	1	0
Mystic-Tobin Bridge (Outbnd)	0	0	0
Interstate I-93[2] (Inbnd)	0	0	0
Interstate I-93 (Outbnd)	0	0	0
S.E. Xway @ Southampton St (Inbnd)	4	9	10
S.E. Xway @ Southampton St (Outbnd)	4	13	17
Mass. Tpk.[2] (Inbnd)	0	0	0
Mass. Tpk. (Outbnd)	0	0	0
Artery, No. of Tunnels (NB)	8	12	3
Artery, No. of Tunnels (SB)	4	8	3
Artery, So. of Tunnels (NB) [3]	5	13	5
Artery, So. of Tunnels (SB) [3]	5	12	4
Storrow Dr., W. of Copley Sq. (Inbnd)	2	2	2
Storrow Dr., W. of Copley Sq. (Outbnd)	0	0	0
Route 1A, No. of Airport (Inbnd) [3]	0	0	0
Route 1A, No. of Airport (Outbnd)	0	0	0
High-Level Bridge (Inbnd)	4	5	0
High-Level Bridge (Outbnd)	8	6	0

1 LOS E or F
2 Beyond influence of Xway/Artery
3 Beyond influence of downstream congestion

Table 17

LEVEL OF SERVICE COMPARISONS
SOUTH BOSTON INTERSECTIONS*

AM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	10	(67)	4	(26)	10	(58)
E	1	(7)	4	(27)	4	(21)
F	4	(26)	7	(47)	5	(21)
TOTAL	15	(100)	15	(100)	19	(100)

PM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	10	(67)	8	(53)	10	(52)
E	0	(0)	1	(7)	2	(11)
F	5	(33)	6	(40)	7	(37)
TOTAL	15	(100)	15	(100)	19	(100)

AM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	10	(67)	4	(26)	9	(47)
E	1	(7)	4	(27)	4	(21)
F	4	(26)	7	(47)	6	(32)
TOTAL	15	(100)	15	(100)	19	(100)

PM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	10	(67)	7	(47)	9	(47)
E	0	(0)	2	(13)	2	(10)
F	5	(33)	6	(40)	8	(42)
TOTAL	15	(100)	15	(100)	19	(100)

* xx = No. of intersections in the category; (xx) = % of intersections in the category.

The Two-Lane Tunnel Concept, during 1990 and 2010 peak hours, would improve overall LOS operations at selected South Boston intersections with few exceptions. During the morning peak hour, the Two-Lane Tunnel Concept would divert some "through" traffic from South Boston local streets, though considerably less than any of the four-lane Third Harbor Tunnel alternatives evaluated in the DEIS/DEIR and SDEIS/SDEIR. This is due to peak hour congestion in the capacity-constrained two-lane Third Harbor Tunnel. This traffic would otherwise be short-cutting on local streets to avoid congestion on the Southeast Expressway/Central Artery. An LOS improvement would not be realized in the PM peak hour with the Two-Lane Tunnel Concept, with the percentage of intersections operating at LOS F essentially the same as with the No-Build Alternative.

East Boston and Revere Intersections V/C's and LOS

Levels of service calculated for the study area intersections in East Boston and Bell Circle in Revere are summarized in Table 18. This summary table was also prepared from Table 13.

From Table 18, overall levels of service without the Two-Lane Tunnel Concept improvements will degrade between 1982 and 2010 during both peak hours. This new traffic, primarily related to Airport growth, is expected to spill over onto local streets in East Boston.

Bell Circle in Revere would continue to operate at LOS F with the Two-Lane Tunnel Concept, but congestion would last longer due to its higher v/c ratio.

The Two-Lane Tunnel Concept would produce only a slight overall improvement, and only in the PM peak hour, in 2010 LOS at the selected East Boston and Revere intersections. This is due to the fact that the Two-Lane Third Harbor Tunnel diverts only airport-related traffic and therefore does not reduce congestion in the existing tunnels as well as the Preferred Alternative. Because of the expected congestion on Route 1A, motorists would attempt to find alternative bypass routes, such as Bennington Street, thus increasing volumes on certain streets. During the PM peak hour, however, the Two-Lane Tunnel Concept improves the operation at two intersections -- Porter Street/Chelsea Street/Visconti Road, and the Airport Cross Road -- from LOS E and F to LOS C-D as compared to the No-Build.

Downtown Boston Intersections V/C's and LOS

Levels of service calculated for the study area intersections in downtown Boston are summarized in Table 19. This tabulation was also prepared from Table 13.

Without the project, selected intersections in downtown Boston will experience an overall degradation in level of service and v/c's between 1982 and 2010 during both peak hours, as traffic increases in the downtown Boston area.

In 2010, the Two-Lane Tunnel Concept would reduce the percentage of selected intersections operating at LOS F during both AM and PM peak hours.

In addition, Leverett Circle operates at a slightly worse LOS relative to the No-Build Alternative, reaching LOS F during both the AM and PM peak hours.

3.1.4 Central Artery Bottlenecks and Congestion Points

Without the Project

Existing and future Central Artery/Southeast Expressway bottlenecks and congestion points with the No-Build Alternative were discussed in Section 3.1 of the

Table 18

LEVEL OF SERVICE COMPARISONS
EAST BOSTON/REVERE INTERSECTIONS (INCL. BELL CIRCLE)*

AM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	16	(89)	12	(75)	12	(75)
E	0	(0)	2	(13)	3	(19)
F	2	(11)	2	(12)	1	(6)
TOTAL	18	(100)	16	(100)	16	(100)

PM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	15	(83)	13	(81)	13	(81)
E	2	(11)	1	(6)	2	(13)
F	1	(6)	2	(13)	1	(6)
TOTAL	18	(100)	16	(100)	16	(100)

AM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	16	(89)	11	(69)	11	(69)
E	0	(0)	1	(6)	1	(6)
F	2	(11)	4	(25)	4	(25)
TOTAL	18	(100)	16	(100)	16	(100)

PM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	15	(83)	10	(62)	12	(75)
E	2	(11)	2	(13)	2	(13)
F	1	(6)	4	(25)	2	(12)
TOTAL	18	(100)	16	(100)	16	(100)

* xx = No. of intersections in the category; (xx) = % of intersections in the category.

Table 19

LEVEL OF SERVICE COMPARISONS
DOWNTOWN BOSTON INTERSECTIONS*

AM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	12	(60)	8	(40)	15	(60)
E	3	(15)	2	(10)	2	(8)
F	5	(25)	10	(50)	8	(32)
TOTAL	20	(100)	20	(100)	25	(100)

PM PEAK

Level of Service	1982 EXISTING		1990 NO-BUILD		1990 Two-Lane Tunnel	
A-D	9	(45)	7	(40)	13	(54)
E	2	(10)	2	(10)	4	(17)
F	9	(45)	1	(50)	8	(32)
TOTAL	20	(100)	20	(100)	25	(100)

AM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	12	(60)	8	(40)	13	(54)
E	3	(15)	2	(10)	1	(4)
F	5	(25)	10	(50)	11	(44)
TOTAL	20	(100)	20	(100)	25	(100)

PM PEAK

Level of Service	1982 EXISTING		2010 NO-BUILD		2010 Two-Lane Tunnel	
A-D	9	(45)	5	(25)	12	(48)
E	2	(10)	4	(20)	2	(8)
F	9	(45)	11	(55)	11	(44)
TOTAL	20	(100)	20	(100)	25	(100)

* xx = No. of intersections in the category; (xx) = % of intersections in the category.

Table 20

INDIVIDUAL QUEUE LENGTH COMPARISONS
TWO-LANE TUNNEL CONCEPT VS. NO-BUILD*

	1990 QUEUES (in miles)				2010 QUEUES (in miles)			
	AM		PM		AM		PM	
	Alt 1	2-Lane Tunnel	Alt 1	2-Lane Tunnel	Alt 1	2-Lane Tunnel	Alt 1	2-Lane Tunnel
North Bound								
Columbia Rd. On-Ramp	0.5	0.7	0	0	0.5	0.3	0	0
Mass. Ave. On-Ramp	1.0	0.9	0	0	1.3	1.3	0	0
Frontage Rd. or E. Berkeley On-Ramp	0.3	0.6	0.5	0	0.6	1.3	0.9	0
Mass Pike On-Ramp	0.9	0	0	0	1.2	0	0.1	0
Atlantic Ave. On-Ramp	0.5	0.8	0.8	0.8	1.5	0.9	0	0
Callahan/Surface Off-Ramp	0	0.8	0.5	0.6	0.1	1.6	0.7	0.9
Storrow Drive Off-Ramp	0	0	0	0.3	0	0.8	0	0.6
High Level Bridge (I-93)	0	0	1.9	0	0	0	2.0	0
South Bound								
High Level Bridge (I-93)	1.4	0.5	0	0	3.2	1.7	0	0
Storrow/Causeway Off-Ramp	0	0.6	0	0	0	1.1	0	0
Callahan Off-Ramp	0.3	0	0.3	0	0.3	0	0.3	0
Sumner/Sudbury On-Ramp	0.6	0.1	0.5	0	0.8	0.4	0.5	0
Dewey Sq. Off-Ramp	0	0	0.5	0	0	0	0.6	0
Mass Pike On-Ramp	0	0	1.5	0.3	0	0	1.4	0.4
Albany St. (Third Harbor Tunnel) On-Ramp	0	0	0.6	0.3	0	0	0.5	0.4
Mass. Ave. On-Ramp	0	0	0.5	0.7	0	0	0.5	0.8
Columbia Rd. On-Ramp	0	0	0.1	0.1	0	0	0.1	0.1

*Queues are not additive where overlaps occur. See text for further explanation.

The Two-Lane Tunnel Concept vs. the No-Build Alternative

Table 20 lists the individual queue lengths, in miles as well as by direction (northbound and southbound), for the Two-Lane Tunnel Concept and the No-Build Alternative at each major congestion point along the Central Artery and Southeast Expressway between the High-Level Bridge and Columbia Circle for 1990 and 2010 AM and PM peak hours.

As Table 20 indicates, bottlenecks and congestion points differ considerably by direction and peak hour. Each individual queue length represents a calculated build-up of vehicles behind a congestion point based on the geometric roadway configuration, number of lanes, anticipated traffic volumes, lengths of trafric weaving sections, and ramp locations. While these individual queues are not additive where they overlap, overall queue formations develop due to the interaction of various congestion points with the longest queue prevailing. However, obtaining information about the individual queues is also critical to the analysis of the Two-Lane Tunnel Concept. It not only provides a basis for comparing its overall effectiveness at reducing individual queues relative to the No-Build Alternative, but is necessary for the design of mitigating measures to alleviate secondary queues which would otherwise remain if a primary queue source is mitigated (e.g., elimination of the High-Level Bridge bottleneck). A major benefit of the Two-Lane Tunnel Concept, as compared to the No-Build Alternative, is removal of the existing High-Level Bridge bottleneck.

This section discusses and compares individual queues and congestion points for the Two-Lane Tunnel Concept and the No-Build Alternative in 1990 and 2010.

Year 1990

Northbound in the AM peak hour, the No-Build Alternative and the Two-Lane Tunnel Concept are expected to generate fairly long queues at the Columbia Road, Massachusetts Avenue, and the Atlantic Avenue on-ramp merges with the Southeast Expressway/Central Artery. The Two-Lane Tunnel Concept would generate a 0.6 mile long queue at the Frontage Road or East Berkeley on-ramp, double the queue length expected with the No-Build Alternative. However, at the Massachusetts Turnpike on-ramp, a 0.9 mile long queue is generated with the No-Build Alternative, but not with the Two-Lane Tunnel Concept. At the Callahan Tunnel/Surface Artery off-ramp diverge point, the opposite situation is expected. With the Two-Lane Tunnel Concept, a 0.8 mile long queue, not expected with the No-Build Alternative, would occur.

Northbound in the PM peak hour, the Two-Lane Tunnel Concept and No-Build Alternative are both expected to generate similar queues at the Callahan/Surface Artery off-ramp (0.5-0.6 miles long), and at the Atlantic Avenue on-ramp (0.8 miles long). With the No-Build Alternative, the High-Level Bridge generates a very long queue of 1.9 miles that would be eliminated with the Two-Lane Tunnel Concept. Similarly, the No-Build Alternative generates a half mile long queue at the East Berkeley/West Fourth Street/Frontage Road on-ramp that would be eliminated with the Two-Lane Tunnel Concept. However, the Two-Lane Tunnel Concept would generate a 0.3 mile long queue at the Storrow Drive off-ramp due to the merge of two lanes on the connector into one lane. This queue is not expected with the No-Build Alternative.

Southbound in the AM peak hour, the High-Level Bridge (as it does northbound in the PM peak hour) is expected to generate a 1.4 mile queue under the No-Build Alternative. This queue will be distributed

approximately 40 percent to the Mystic-Tobin Bridge (0.6 miles long) and 60 percent to Interstate Route 93 southbound (0.8 miles long). This bottleneck and its associated queue would be eliminated with the Two-Lane Tunnel Concept. The Two-Lane Tunnel Concept would eliminate a 0.3 mile long queue at the Callahan Tunnel/ Haymarket off-ramp, and would reduce a 0.6 mile long queue expected at the Sumner Tunnel/Sudbury Street on-ramp merge to 0.1 miles long.

Southbound in the PM peak hour, the primary 1.5 mile queue found at the Massachusetts Turnpike on-ramp with the No-Build Alternative would be reduced substantially with the Two-Lane Tunnel Concept to a 0.3 mile long queue. While a shorter queue would be expected at the Albany Street on-ramp with the Two-Lane Tunnel Concept (0.3 miles long versus 0.6 miles long for the No-Build Alternative), the Massachusetts Avenue on-ramp would generate a slightly longer queue with the Two-Lane Tunnel Concept (0.7 miles long) than with the No-Build Alternative (0.5 miles long). The short 0.1 mile long queue anticipated at the Columbia Road on-ramp is the same with both alternatives. Otherwise, the Two-Lane Tunnel Concept would eliminate queues anticipated at the Callahan Tunnel off-ramp, the Sumner Tunnel/Sudbury Street on-ramp, and the Dewey Square off-ramp with the No-Build Alternative.

Year 2010

As noted previously, Table 20 lists the primary individual congestion points and queue lengths for 2010 traffic conditions. With few exceptions, the queues generated under 2010 traffic conditions are either lengthened or stay approximately equivalent to 1990 queues. The discussion below focuses on the most significant changes between the analysis years.

Northbound in the AM peak hour, both the Two-Lane Tunnel Concept and the No-Build Alternative are expected to generate many long individual queues. A long queue of 1.3 miles is found with both the Two-Lane Tunnel Concept and the No-Build Alternative, originating from the Massachusetts Avenue on-ramp. With the Two-Lane Tunnel Concept, the Callahan Tunnel/Surface Artery off-ramp would generate a queue substantially longer than anticipated with the No-Build Alternative (1.3 miles long versus 0.6 miles long and 1.6 miles long versus 0.1 miles long, respectively). With the No-Build Alternative, however, the Atlantic Avenue on-ramp generates a 1.5 mile long queue which would be reduced to a 0.9 mile long queue with the Two-Lane Tunnel Concept. A new 0.8 mile long queue expected at the Storrow Drive off-ramp due to the reduced number of lanes with the Two-Lane Tunnel Concept will not occur with the No-Build Alternative.

Northbound in the PM peak hour, the queue from the High-Level Bridge lengthens considerably to 2.0 miles with the No-Build Alternative. This queue is eliminated with the Two-Lane Tunnel Concept. In addition, queues of 0.9 miles and 0.1 miles, respectively, at the Frontage Road or East Berkeley and the Massachusetts Turnpike on-ramps would be eliminated with the Two-Lane Tunnel Concept. However, the diverge of the Callahan Tunnel/Surface Artery from the Central Artery would generate a longer queue on the Central Artery with the Two-Lane Tunnel Concept (0.9 miles versus 0.7 miles) than expected with the No-Build Alternative. Storrow Drive, with the Two-Lane Tunnel Concept, is expected to generate a new 0.6 mile long queue that will not occur with the No-Build Alternative.

Southbound in the AM peak hour, the High-Level Bridge is again expected to generate a very long 3.2 mile queue distributed between Interstate Route 93 and the Mystic-Tobin Bridge with the No-Build Alternative. The Two-Lane Tunnel Concept reduces this queue to 1.7 miles -- still of significant length; meanwhile, the Storrow Drive/Causeway Street ramp with the Two-Lane Tunnel

Concept would generate a new 1.1 mile long queue not expected under the No-Build Alternative. The Summer Tunnel/Sudbury Street on-ramp queue would be twice as long with the Two-Lane Tunnel Concept (0.8 miles versus 0.4 miles) than expected with the No-Build Alternative.

Southbound in the PM peak hour, as shown in Table 20, queues are very similar to those generated in 1990 for both alternatives.

3.1.5 Vehicle Miles, Vehicle Hours, and Person Hours of Travel

Vehicle miles of travel (VMT) is a measure of the total distance travelled by all vehicles on a study area roadway system. Similarly, vehicle hours of travel (VHT) and person hours of travel (PHT) are measures of the total travel times expended by all vehicles and persons using this same roadway system. For example, two persons travelling in an automobile for 20 miles in 1 hour generate 20 VMT, 2 PHT, and 1 VHT. VMT and PHT are used as indicators of the effectiveness of improvements to the roadway system in providing transportation benefits to travellers (in terms of savings in travel distance or time and related travel costs) and secondary environmental benefits to the general population (reduced energy consumption, air pollution, etc.).

VMT and PHT have been calculated on an annual basis. The geographical area covered by projections for this study includes the communities of Boston, Brookline, Cambridge, Chelsea, Everett and Somerville. These localities are most likely to be affected by proposed roadway improvements. Year 2010 projected VMT and VHT for the No-Build Alternative and the Two-Lane Tunnel Concept are as follows:

No-Build Alternative
Annual VMT = 3.3 billion miles
Annual VHT = 150.1 million hours
Annual PHT = 223.4 million hours

Two-Lane Tunnel Concept
Annual VMT = 3.4 billion miles
Annual VHT = 157.7 million hours
Annual PHT = 213.1 million hours

Differences - Two-Lane Tunnel Concept vs. the No-Build Alternative
Annual VMT = +68.6 million miles
Annual VHT = + 7.6 million hours
Annual PHT = -10.3 million hours

As listed above, the Two-Lane Tunnel Concept decreases vehicle miles travelled by 0.7 percent as compared to the No-Build Alternative. Even though its roadway network carries an additional 12,800 daily vehicle trips, the Two-Lane Tunnel Concept incorporates various design improvements (e.g., a depressed, widened Central Artery and a new two-lane tunnel serving Logan Airport), which allow motorists to take more direct routes rather than diverting to local streets in downtown Boston and South Boston. In addition, the Two-Lane Tunnel Concept features a "split alignment" (six southbound lanes through the Dewey Square Tunnel and four northbound lanes along the Fort Point Channel) rather than a "two-way alignment" (three northbound and three southbound lanes through the Dewey Square Tunnel) in downtown Boston. It also provides new, more direct access to the developing Northern Avenue area in South Boston. This results in a reduction of total vehicle miles travelled compared to the No-Build Alternative.

The Two-Lane Tunnel Concept also shows a decrease of 1.1 percent in total vehicle hours of travel when compared to the No-Build Alternative. With a 3.8 percent decrease in person hours travelled, it also provides a user-benefit (or travel time) savings. This reduction results from increased travel speeds made possible because of increased capacity and resulting improved levels of service. The increased capacity and improved service of a depressed, widened Central Artery also encourages "through" motorists to stay on the Central Artery rather than divert to

local streets. East Boston is the only one of the three sub-areas (downtown Boston, South Boston, and East Boston) that does not benefit measurably from reduced travel times with the Two-Lane Tunnel Concept.

3.1.6 Safety

Accident Potential

Highway System

Table 21 summarizes predicted yearly accidents along the Central Artery/Southeast Expressway, including approaches to the existing and Third Harbor Tunnels and to the existing and proposed tunnel approaches in East Boston for the No-Build Alternative and the Two-Lane Tunnel Concept. For comparison purposes, the average annual number of accidents occurring at these locations between 1978 and 1980 is also contained in Table 21.

Discussions of existing accident history on these major highway sections, as well as predicted 1990 and 2010 accident potential without the project (No-Build Alternative), are contained in Section 3.1.2 of the FEIS volume. In summary, total accidents on the major highway sections are estimated to increase over existing levels by 9 percent in 1990 and 21 percent in 2010. The increases result from increased traffic on the roadway network.

The Two-Lane Tunnel Concept reduces accident potential on the regional highway system in 1990 by 22 percent and 2010 by 23 percent in comparison to the No-Build Alternative.

Local Roadway System Accidents

Projections of future accident potential at local intersections in South Boston, East Boston, and downtown Boston are summarized in Table 22. Existing accidents (1978-1980 average) are also included for comparison purposes.

A discussion of existing accident history and predicted accident potential for 1990 and 2010 without the project (No-Build Alternative) is also contained in Section 3.1.2 of the FEIS/FEIR. In summary, total annual accidents at the selected intersections in South Boston will increase by 17 percent in 1990 and 24 percent in 2010 with No-Build Alternative conditions. Increases are due to predicted regional traffic growth and new traffic generated by proposed developments in South Boston. In East Boston, the growth in total number of accidents at the selected intersections will be more modest, with values of 5 percent for 1990 and 12 percent in 2010. The highest percentage growth in the total number of accidents expected to occur will be for the selected intersections in downtown Boston, reflecting the major increases in traffic predicted for local streets in that area. From 1982, the percentage growth in accidents predicted in downtown Boston is 24 percent by 1990 and 32 percent by 2010. For the selected intersections in South Boston, East Boston, and downtown Boston combined, accident potential without the project (No-Build Alternative) will increase 16 percent by 1990 and 24 percent by 2010 over existing conditions.

In general, for South Boston, in 2010, the Two-Lane Tunnel Concept would reduce the total number of accidents for the analyzed intersections by 2 percent when compared to the No-Build Alternative.

Within East Boston, in 2010, the overall total number of accidents at the selected intersections would decrease by approximately 8 percent for the Two-Lane Tunnel Concept compared to the No-Build Alternative (vs. zero percent reduction for the Preferred Alternative).

The total number of accidents in downtown Boston for the selected intersections studied would decrease by 9 percent with the Two-Lane Tunnel Concept as compared to the No-Build Alternative in 2010.

Overall, for the local streets

Table 21

FUTURE REGIONAL HIGHWAY SYSTEM ACCIDENT SUMMARY

	Average Existing 1978-1980	No-Build 1990	No-Build 2010	2-Lane Tunnel Concept 1990	2-Lane Tunnel Concept 2010
Central Artery					
Section 1*	381	454	470	365	387
Section 2*	235	260	284	227	241
Section 3*	197	201	232	152	159
Section 4*	200	203	206	161	185
Subtotal	1013	1118	1192	905	972
East Boston Tunnel Approaches	159	164	226	98**	121**
TOTAL	1172	1282	1418	1003	1093

* Section 1: Rte I-93/Rte 1 to Causeway Street
Section 2: South of Causeway Street to Callahan/Sumner Tunnels
Section 3: South of Tunnels to Beach Street
Section 4: Kneeland Street to Southampton Street

** Includes estimated future accidents on Third Harbor Tunnel roadways and approaches.

Table 22

FUTURE LOCAL ROADWAY SYSTEM ACCIDENT SUMMARY

	Average Existing 1978-1980	No-Build 1990	No-Build 2010	2-Lane Tunnel Concept 1990	2-Lane Tunnel Concept 2010
South Boston					
Columbia Road/Old ColonyAve./ Day Blvd.	11	14	15	9	9
Andrew Square	8	11	12	7	9
Columbia Road/Day Blvd./L St.	5	5	5	4	4
L St./Summer St./E. First St.	7	9	9	9	9
Dorchester Ave./W. Broadway	9	9	10	12	12
Summer St./D St.	10	10	10	11	11
Dorchester Ave./W. Fifth St./A St.	10	9	10	11	11
Dorchester Ave./W. Fourth St.	10	10	10	12	13
Congress St./A St.	4	6	7	11	12
Northern Ave./Sleeper St.	8	13	14	10	10
SUBTOTAL	82	96	102	96	100
East Boston					
Condor St./Meridian St.	13	13	14	14	14
Bennington St./Bremen St.	7	7	8	6	7
Bennington St./Chelsea St.	23	24	25	22	22
Meridian St./Bennington St.	13	14	15	14	14
Porter St./Cottage St.	2	3	3	1	3
SUBTOTAL	58	61	65	57	60
Downtown Boston					
Causeway St./No. Washington St.	26	31	34	22	24
Congress St./North St.	11	14	15	13	16
New Chardon St./Merrimac St.	10	10	10	10	10
New Chardon St./No. Washington St.	5	6	6	8	9
Sudbury St./Congress St.	22	31	33	31	30
SUBTOTAL	74	92	98	84	89
TOTAL	214	249	265	237	249

within South Boston, East Boston, and downtown Boston, the total number of annual accidents with the Two-Lane Tunnel Concept in 2010 is estimated at 249 as shown in Table 22. The total for the No-Build Alternative is estimated at 265. This represents a 6 percent improvement in safety at local intersections within the study area (vs. a 3 percent improvement with the Preferred Alternative).

Accident Potential: Regional Highways and Local Roadways Combined

Combining the accident potential estimates for selected regional highway and local roadway sections contained in Tables 21 and 22 results in a 19 percent reduction in accident potential in 1990 and a 20 percent reduction in 2010 for the Two-Lane Tunnel Concept compared to the No-Build Alternative.

Hazardous Cargoes

The Two-Lane Tunnel Concept would change the routing of hazardous cargo vehicles through downtown Boston. These routing changes are mainly a result of the depression of the Central Artery into a tunnel through which passage of such vehicles will be prohibited.

Both the Two-Lane Tunnel Concept and the No-Build Alternative would have the same routing of hazardous cargoes to avoid the Dewey Square Tunnel through downtown Boston.

Modifications to the existing roadway circulation patterns in the Chinatown section of Boston are included as a part of the Two-Lane Tunnel Concept. These modifications would alter future hazardous cargo routes through downtown Boston as described below.

Southbound hazardous cargoes would exit the Central Artery using the Causeway Street off-ramp, and join the southbound Surface Artery traffic at Haymarket Square. Between Dewey Square and Kneeland Street, southbound hazardous cargoes would use the new Surface Artery.

Northbound hazardous cargoes would also use the new Surface Artery between Kneeland Street and the Causeway Street northbound Central Artery on-ramp.

Movements of hazardous cargo vehicles through South Boston would also improve as a result of the Two-Lane Tunnel Concept. Relative to a Seaport Connector Road which is assumed to be constructed by others with the No-Build Alternative, the Two-Lane Tunnel Concept diverts some additional 2,200 trucks per day, many of which would carry hazardous cargoes, from the local surface street network to the Interstate-quality Seaport Access Alignment Tunnel.

Emergency Vehicle Access

The Two-Lane Tunnel Concept would improve access across Boston Harbor for fire, police, ambulance, and other emergency vehicles. Emergency vehicles with the Two-Lane Tunnel Concept would be able to respond to calls faster due to reductions in travel times on major highways, as mentioned previously. A new two-lane tunnel provides an alternative travel route for emergency vehicles in the event that one or both of the existing tunnels become blocked temporarily due to an accident or other reasons.

The Two-Lane Tunnel Concept would add one travel lane in each direction along the Central Artery. This additional capacity would serve to decrease congestion and increase travel speeds for emergency vehicles needing to use this facility. Additionally, the improved connections between the Callahan/Summer Tunnels and the Central Artery or surface street system with the Two-Lane Tunnel Concept would, in general, offer improved travel times for emergency vehicles passing through this area. The effectiveness of the Two-Lane Tunnel in providing an alternative route for emergency vehicle access,

however, is somewhat diminished relative to the Preferred Alternative by the reduced tunnel capacity.

The No-Build Alternative does not offer these improved connections and resulting travel time improvements, since the redecking of the existing Central Artery will neither increase capacity (north-south or east-west) nor reduce congestion in the project area.

3.1.7 Other Transportation Facilities

Ferry Services

In the long term, the No-Build Alternative will most likely increase patronage on harbor ferry services used for commuter purposes. That is, as congestion and delays on the Central Artery and Southeast Expressway become more severe with the No-Build Alternative, additional motorists can be expected to change modes from the private automobile to commuter ferry. Since the Southeast Expressway will continue to be congested with the Two-Lane Tunnel Concept, commuter ferry patronage should increase in a similar fashion.

Logan Airport

As detailed in Section 3.1 of the FEIS/FEIR, roadway connections between Boston and the Airport will become increasingly more congested through 2010 with the No-Build Alternative. This situation will occur as traffic volumes equal to or exceeding the capacity of the Central Artery approaches to the existing tunnels, the tunnels themselves, the Route 1A ramps connecting the tunnels with the Airport access/egress roadway system, and the internal Airport roadway system.

In addition, with the No-Build Alternative, average vehicle occupancies on the Central Artery (i.e., the number of persons per vehicle) will increase as more persons divert to alternative travel modes (e.g., the Blue Line rapid transit system, bus services, taxis, and airport limousines), rather than contend with the intensifying congestion in one or two occupant vehicles.

The traffic forecasting procedure for this EIS/EIR assumed that the Two-Lane Tunnel Concept (as was assumed for all build alternatives including a Third Harbor Tunnel) will attract some 12,800 more vehicle trips per day than the No-Build Alternative in the year 2010; most of these trips were assumed to be diversions from public transportation and other high occupancy vehicles (i.e., carpools, taxis, vanpools, etc.).

The major positive impact of the Two-Lane Tunnel Concept on Logan Airport would be to improve traffic circulation and access to the Airport and, specifically, to Bird Island Flats from the south which would have separate access ramps from the two-lane Third Harbor Tunnel. The Two-Lane Tunnel Concept also provides a more direct connection into the passenger terminal area of the Airport than does the No-Build Alternative from the south only. Motorists entering or leaving the Airport via Route 1A will continue to experience congestion, although the Callahan and Sumner Tunnels would be less congested than with the No-Build Alternative. The implementation of the Two-Lane Tunnel Concept may require minor design refinements to conform fully with the Logan Airport master plan to double-deck access to airline terminals. However, the design of the Two-Lane Tunnel Concept has been coordinated with Massport officials.

Public Transportation

The No-Build Alternative will increase long-term demands for cross-harbor public transportation as a result of increased congestion on the highway network.

The long-term impacts of the Two-Lane Tunnel Concept on the many MBTA bus routes within the study area would be minor in terms of required routing changes resulting from changes

in the roadway network configuration. Most of these changes would affect bus routes serving Haymarket Station.

Buses entering Boston via Interstate Route 93 to Haymarket Station would be required to use the new Causeway Street off-ramp rather than the previously-used Haymarket Square off-ramp. While some delays may be experienced by buses using this ramp at the Causeway Street intersection, buses entering Haymarket Station previously were delayed on the Central Artery and on the Haymarket exit ramp because of heavy traffic volumes on the highway and on the local roads. MBTA buses would generally benefit from improved downtown Boston traffic circulation.

Other changes in the local street network resulting from a depressed Central Artery with the Two-Lane Tunnel Concept would be beneficial for selected MBTA bus routes using the Haymarket Station. Specifically, a new on-ramp to the Central Artery northbound would be provided from North Washington Street. Combined with improvements to make the Surface Artery continuous, this new ramp would provide a shorter travel distance and travel time for buses which now travel south on Blackstone Street from Haymarket Station to North Street and merge with traffic bound to and from the Callahan and Sumner Tunnels before entering the northbound Central Artery. Bus routes from the north would also be able to avoid City Square in Charlestown by using this new on-ramp. Express bus services to other North Shore communities would also benefit from proposed roadway configuration changes. These bus routes, described previously in the DEIS/DEIR, would be able to use a new on-ramp from Haymarket Square directly into the Callahan Tunnel, thus bypassing the existing heavily congested intersection of Blackstone Street/North Street/Central Artery off-ramp.

Other than at Broadway Station, as mentioned above, MBTA bus routes in South Boston would not be directly affected by the implementation of the Third Harbor Tunnel portion of the Two-Lane Tunnel Concept through South Boston, since buses would be able to use the same streets as they do today. However, improvements to bus service in South Boston could result by use of the new two lane Third Harbor Tunnel system and its two new interchanges connecting with Congress Street, Summer Street and Northern Avenue.

The Two-Lane Tunnel Concept would provide a major improvement to all northbound buses to be consolidated at South Station Transportation Center. The depressed and widened Central Artery and Two-Lane Third Harbor Tunnel would reduce travel times for all connections to and from both the Airport and points north for private operators such as Greyhound, Trailways, and Vermont Transit.

Overall, highway-dependent public transportation service in the study area would improve over the No-Build Alternative with the Two-Lane Tunnel Concept.

Commuter rail services to and from Boston's North and South Stations would not be directly affected in the long term by the Two-Lane Tunnel Concept because of provisions to relocate tracks and maintain services. Amtrak services to South Station would be affected during construction. Close coordination would be maintained between Amtrak, the FRA, and the MBTA during construction. In the long term, Amtrak services would not be adversely affected.

3.1.8 Construction Impacts

The No-Build Alternative, with redecking, will require a construction period of about three years. The No-Build Alternative, like the Two-Lane Tunnel Concept, will have several construction impacts.

The redecking construction

staging procedure for the No-Build Alternative calls for travel lanes on the Central Artery to be narrowed. This reduction in lane capacity will degrade traffic levels of service, on occasion extending congested peak operating conditions into what are normally off-peak hours.

On the Central Artery south of Causeway Street, one lane at a time will be out of service, with temporary by-pass lanes used to maintain six through lanes whenever possible. The Central Artery currently operates above its theoretical capacity -- i.e., at peak conditions -- for 4 to 8 hours of the day. Traffic flow is subject to breakdown from relatively minor disruptions during these hours. During the redecking, along with the slowing of traffic resulting from the normal curiosity factor (i.e., "rubber-necking") associated with any roadside disturbance, the capacity of the Artery will be reduced at construction zone bypasses as 12-foot lanes are channelized into narrower 11-foot lanes. Vehicle operating speeds will decrease sharply in these areas. The resulting 10 percent reduction in capacity will cause additional bottlenecks with lengthier queues. The impact of the increased traffic on the Central Artery will be realized on its connecting expressways (particularly Interstate Route 93 to the north and the Southeast Expressway to the south).

With respect to the maintenance of regional traffic flow, redecking the High-Level Bridge area is of greater concern. Due to the bottleneck at this location and double-decking of the northbound and southbound directions of the Central Artery on the bridge, it will be impossible to maintain three lanes in each direction during peak hours. Resulting additional congestion and queuing would occur for at least an 18-month period while the bridge and Leverett Circle connections are being redecked.

Also during the redecking construction period, traffic diversions from the Southeast Expressway/Central Artery to parallel local roadways will occur during the peak and off-peak hours, adding to congestion on adjacent surface streets in South Boston, downtown Boston, and East Boston.

Traffic flow on all Central Artery ramps will be maintained at all times during redecking. At least half the width of each ramp (11 feet) will be available for use at all times while the remaining half is being reconstructed. Also, one or two lanes of the Surface Artery, depending upon location of the redecking operation, will be closed in the immediate area(s) under the construction zone. These closures will result in some additional congestion on the Surface Artery as traffic attempts to move through the construction area. Once traffic has bypassed the construction area, normal capacity (i.e, number of lanes) on the Surface Artery will be available for traffic movements. These impacts will be most notable during the peak periods, but will also cause motorists inconvenience during the off-peak hours of the day.

Overall, the Two-Lane Tunnel Concept would have more significant local street network traffic impacts during construction than the No-Build Alternative. The redecking, however, requires construction activity throughout the full length of the Central Artery through downtown Boston. Therefore, when examining the construction period impacts on regional expressway traffic, the Two-Lane Tunnel Concept has the benefit of leaving the existing Central Artery in service throughout the construction period (including a phase, near the end of construction, in which the Artery would be in use in <u>addition</u> to the new underground roadway). At the end of the Two-Lane Tunnel Concept construction period, all traffic would be transferred to the new depressed Central Artery, allowing the demolition of the existing structure to occur.

In short, while the

construction time period would be longer for the Two-Lane Tunnel Concept and the disruption to traffic using the local street network would be more severe, the provision of continuous through service for the heavy component (60-65 percent) of regional traffic on the Central Artery would be better handled by the Two-Lane Tunnel Concept than by redecking with the No-Build Alternative.

The Two-Lane Tunnel Concept would be expected to require a construction period of about 12 years because of its depressed Central Artery section. The analysis of construction traffic impacts over the 12-year construction period for the Two-Lane Tunnel Concept covers five corridors:

- South Boston;
- South Bay/Fort Point Channel corridor;
- Central Artery/Surface Artery corridor from Dewey Square north to Causeway Street;
- The Storrow Drive/Leverett Circle connector ramps from Causeway Street to the Central Artery North Area Project; and,
- Logan Airport (East Boston).

It has been assumed that construction of the South Boston and South Bay/Fort Point Channel sections would commence simultaneously with construction of the depressed Central Artery.

Each of the five construction corridors has construction sequences described in Chapter 2.0 of this document. Construction staging sequences have been organized to maximize maintenance of major traffic flows throughout construction. This section focuses on the critical traffic implications of those construction periods.

Construction of the South Boston, South Bay/Fort Point Channel, East Boston, and Central Artery corridors has been assumed to begin in January 1987. Construction of the Third Harbor Tunnel is expected to be completed by January 1991. This date also marks the expected start of construction of the Storrow Drive/Leverett Circle ramp connections to the Central Artery; within the overall 12 year construction period, this construction may be revised to accommodate land development considerations.

Construction period impacts are summarized below by corridor. The discussion of each corridor includes, where appropriate, a description of the traffic implications of construction activities in other adjacent corridors that interact with activities in the corridor being discussed.

South Boston

Like the No-Build Alternative (which includes a small-scale Seaport Connector Road by others), the Two-Lane Tunnel Concept directly affects the interior of South Boston to the east of the Fort Point Channel. Its construction would require the temporary use of detour roads at several locations, though, for the most part, existing traffic patterns would be maintained.

Of particular importance is the need to replace the Summer Street bridge over the railroad tracks. (It is important to note, however, that the Summer Street Bridge is currently posted for weight restrictions and will need to be replaced with or without the project.) The existing bridge would first be replaced by an adjacent temporary four-lane bridge for approximately one year. Adverse traffic impacts during this period should be minimal, as either the existing or the temporary bridge would be in service at all times. However, for two months prior to the use of this temporary structure, repairs to the retaining walls of the existing bridge, required as part of the Summer Street Bridge replacement, would

reduce the capacity of the bridge by 50 percent. This can be expected to cause some delays to Summer Street traffic, especially during peak hours. When the new bridge has been completed, Summer Street traffic would be switched from the temporary bridge to the new structure, with no interruptions in traffic service.

A short segment of A Street would be replaced for five months by a temporary two-lane bypass while construction of the tunnel proceeds beneath it. Later in the construction process, traffic on the easternmost segment of Northern Avenue and the private EDIC access road (also referred to as "A" Street, which is not the same "A" Street mentioned above) to the east of Commonwealth Pier would operate over a short four-lane temporary bypass during Third Harbor Tunnel construction for a four-month period. Travel delays on both detours would be minimal.

Viaduct-Ramp Street would also be closed for an estimated two year period. An elaborate detour would be required. B Street, in the vicinity of its intersection with Congress Street, would remain open, serving as part of the detour to maintain access to the Commonwealth Pier area via local streets from the south. While motorists who formerly used Viaduct-Ramp Street in this area would find the detour to be circuitous, discouraging north-south local traffic movements would be consistent with local South Boston traffic planning objectives.

Only Congress Street between B Street and the new on-off ramps to the Third Harbor Tunnel would be closed permanently as a result of the construction of the Two-Lane Tunnel Concept. While this closure would inconvenience some motorists presently using Congress Street (the 1982 AWDT volume in this area is 3,500 vpd), they would be able to divert to Northern Avenue which has the capacity to handle the additional traffic at an acceptable level of service.

During the Two-Lane Tunnel Concept construction process, it is anticipated that the new Third Harbor Tunnel on-off ramp service road between Congress Street and Northern Avenue, the new easterly on-off ramp system connecting the Third Harbor Tunnel Access Road with Summer Street and Northern Avenue, as well as the Third Harbor Tunnel roadway between the Southeast Expressway/Massachusetts Turnpike and these interchanges, would be ready for use approximately three to four years (no later than January 1991) into construction. The availability of these roadways and interchanges would significantly improve access from the south and southwest to the northern sections of South Boston while simultaneously removing truck and automobile traffic from various Fort Point Channel bridges and connecting roadways.

South Bay/Fort Point Channel Crossings

Construction of the Two-Lane Tunnel Concept in the South Bay/Fort Point Channnel area is identical to that described in the SDEIS/SDEIR for Alternative 5A. Reference is made to that document, Section 4.2.8, for the traffic impacts associated with the construction of the Two-Lane Tunnel Concept in this area.

Central Artery/Surface Artery Corridor

For the first four years of construction, the Two-Lane Tunnel Concept in the Central Artery/Surface Artery corridor would be identical to that described in the SDEIS/SDEIR for Alternative 6. This is because direct access to the Callahan/Summer Tunnels would be available to vehicles travelling both north and south on the Central Artery. For a description of the traffic impacts in this area during this period, refer to the SDEIS/SDEIR, Section 4.2.8.

There is, however, a difference between the construction traffic impacts of the Two-Lane Tunnel Concept

during the construction period after the two-lane Third Harbor Tunnel is open for use, and just prior to when one lane of the Callahan and Sumner Tunnels are alternately closed and opened for a two-year period (beginning four years after the start of construction). With the Two-Lane Tunnel Concept, with a two-lane Third Harbor Tunnel available for traffic movement, traffic impacts would not be as severe as under Alternative 6. This is because some of the Logan Airport traffic destined to and from the South would be able to use the Third Harbor Tunnel. Therefore, the same number of cross harbor traffic lanes (two in each direction) as existing could be maintained during this period.

Traffic on the Central Artery between the Third Harbor Tunnel and the Callahan/Sumner Tunnels would be less than would be expected with Alternative 6, after the Third Harbor Tunnel is opened, because of the diversion of Central Artery traffic to parallel local streets until the completion of the Central Artery depression construction, late in 1999.

Otherwise, construction traffic impacts in the Central Artery area are similar to those described in Section 4.2.8 of the SDEIS/SDEIR for Alternative 6.

Storrow Drive/Leverett Circle Connecting Ramps from Causeway Street to the MDPW's North Area Project Limits

Construction of the Storrow Drive/Leverett Circle connecting ramps, for purposes of this analysis, has been assumed to begin in the fifth year of construction. The expected construction traffic impacts during this period are identical to those described for Alternatives 3A, 5A, and 6 in the SDEIS/SDEIR. Reference is made to Section 4.2.8 of that document for a full description of these impacts.

Logan Airport (East Boston)

Construction at Logan Airport and East Boston with the Two-Lane Tunnel Concept would proceed concurrently with construction activities in South Boston to assure that the Third Harbor Tunnel is available when lane closures on the Callahan/Sumner Tunnels are required as mentioned previously.

With the exception of additional trucks, traffic impacts associated with construction are only expected to be minor since final connections to existing Logan Airport roadways and Bird Island Flats could be made without interrupting traffic flow. All construction at Logan Airport is expected to be completed by 1991.

Public Transportation

No-Build Alternative

The No-Build Alternative should have minimal impacts on transit services during redecking; impacts will relate only to public and private bus carriers whose routes include the Central Artery. As indicated earlier, a 5 to 10 percent reduction in Central Artery capacity will cause some increased delays and longer travel times for buses.

Preferred Alternative

It is probable that ridership on all MBTA rapid transit lines serving downtown Boston would increase during construction of the depressed Central Artery. Many motorists who have the option would divert to transit because of increased delays to automobile traffic.

Red Line Rapid Transit. As indicated in the SDEIS/SDEIR (including Section 4.2.7 and Appendix 4), operation of the MBTA's Red Line service under the Fort Point Channel would not be affected by construction

of the Two-Lane Tunnel Concept. Any sensitive construction would be accomplished during night periods when the rapid transit line does not operate.

Blue Line Rapid Transit. Construction of the Two-Lane Tunnel Concept would not affect the Blue Line in East Boston, since Route 1A is not involved in any of the construction.

In downtown Boston, a depressed Central Artery would pass directly over the Blue Line tunnel under State Street. Disruptions brought about by interior tunnel strengthening would be minimized by a requirement that all sensitive construction occur during night periods when there is no Blue Line service.

Orange and Green Lines Rapid Transit. Both the MBTA's Green and Orange Lines are located adjacent to the Central Artery in the North Station/Haymarket Square area. At the Haymarket portal, a temporary ramp passing over the Green Line would be constructed to serve traffic diverted from the closure of the New Chardon Street Ramp. Also, a replacement parking facility may be built in this same Canal/Haverhill Street area. No major disruptions to MBTA service are expected during the construction of this air rights facility.

Bus Services. Construction of the Two-Lane Tunnel Concept in the Fort Point Channel area would temporarily close or reduce the capacity of bridges across this waterway. Several MBTA local bus routes use these bridges to provide service between South Boston and other locations. These routes would be affected by construction, with detours necessary as bridges are completely closed. Increased delays due to increased congestion and more circuitous routes would result in an overall degradation in the quality of bus service in South Boston during the construction period. These impacts, as described in the SDEIS/SDEIR and Appendix 4 to the DEIS/DEIR, (described for Alternatives 3 and 5) also apply to the Two-Lane Tunnel Concept.

Within downtown Boston, in general, express bus services, in particular, would experience an increase in ridership during construction.

The MBTA operates numerous local and regional bus routes within downtown Boston. Many of these routes would be disrupted during the construction of a depressed Central Artery, particularly those serving the Haymarket Square area. These disruptions would arise from general increases in traffic congestion in this area caused by the construction process, resulting in delays and longer trip times, as well as from possible changes in routings due to various roadways being taken out of service either temporarily or permanently. Some delays or reroutings of services provided by other bus companies which use the Southeast Expressway and/or the Central Artery could also be expected during the construction process.

Within East Boston, service on MBTA express bus routes which use Route 1A would be subjected to minor additional delays due to the increase in truck traffic and congestion approaching downtown Boston during the depression of the Central Artery. Otherwise, there would be few impacts on East Boston bus services since there is no Route 1A construction with the Two-Lane Tunnel Concept.

Airport Bus, Limousine, and Taxi Services. Minor delays to traffic entering or leaving Logan Airport could be expected during the construction of the Two-Lane Tunnel Concept. As explained in the SDEIS/SDEIR, the main access roadways and ramps would remain open at all times, although there may be temporary detours or capacity (width) restrictions.

Passenger Rail Services. Construction in the South Bay area would require the temporary relocation

of several railroad tracks near the interchange of the Central Artery with the Massachusetts Turnpike. These tracks are used for both local commuter rail and long distance Amtrak services. Tie-ins of the temporary detour tracks would be made during periods of little or no scheduled train service, such as at night or on weekends, in order to keep any disruptions of service to an absolute minimum.

At North Station, while construction of new ramp connectors between the Central Artery and Storrow Drive proceeded under the ten existing tracks, it would be necessary to construct seven new tracks for temporary use by the MBTA/B&M Railroad. Again, service disruptions should be minimal since all connections to these temporary tracks would be made during periods of little or no service.

Ferry Services. No delays to the commuter ferry services provided within Boston Harbor would be anticipated as a result of the construction of the Two-Lane Tunnel Concept or the No-Build Alternative. Both would increase patronage on ferry services during roadway construction. These increases would be caused by motorists seeking to avoid construction-related delays to traffic. It may be necessary for the ferry companies to schedule additional trips in order to accommodate the expected patronage increase.

3.2 RELOCATION IMPACTS

In the discussions which follow, all references to acquisition of properties or buildings refer only to those properties or buildings whose tenants'/owners' businesses would be displaced by the proposed project. Other property acquisitions would occur as part of this project, but would not involve business displacements. Where mitigating measures are necessary to ensure the continuance of business operations during the construction phase, they are discussed in Section 4.4 LAND USE IMPACTS of the FEIS.

3.2.1 Business/Government Agency Takings

The Two-Lane Tunnel Concept would require partial or total takings necessitating the relocation of 111 businesses and 3,600 employees. Nine parking lots located under the existing Central Artery and owned by the City of Boston and the MDPW are permanently taken. Provision for replacement parking is discussed in Section 4.4 LAND USE IMPACTS, of the FEIS.

3.2.2 Displaced Businesses and the Availability of Comparable Relocation Space

This section identifies the affected businesses and reviews the availability of comparable relocation space for those affected.

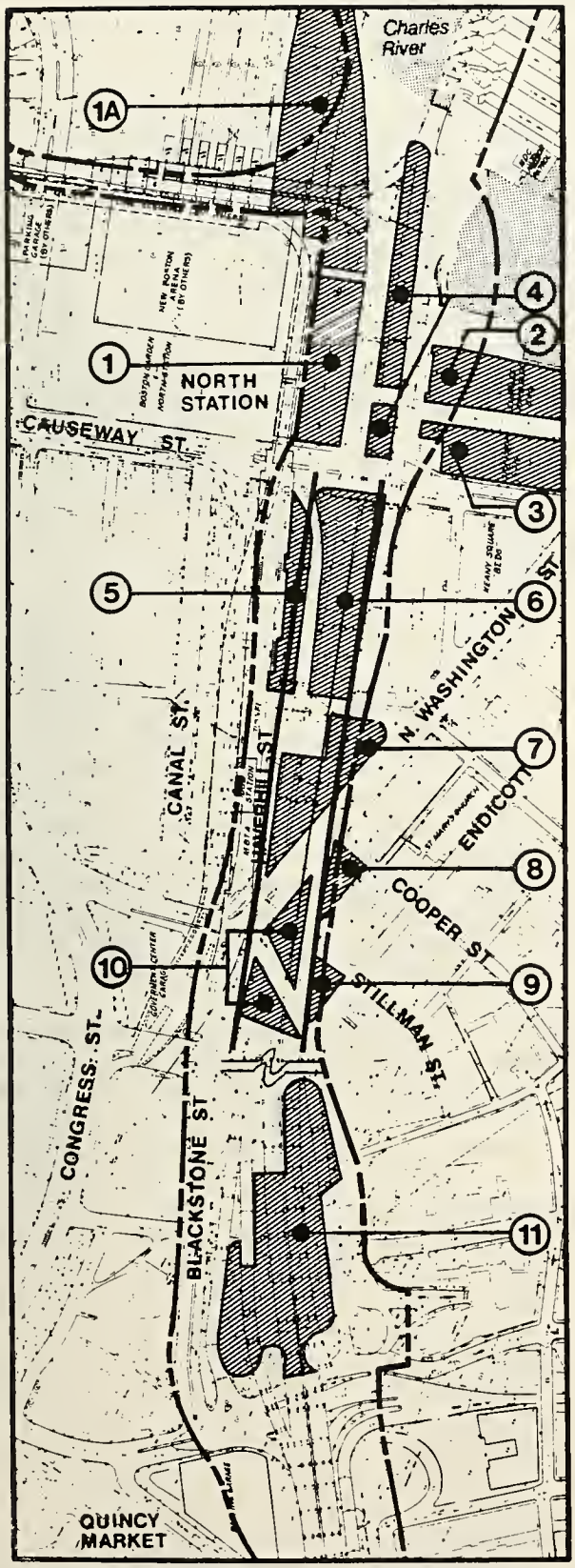
Area North of Dewey Square

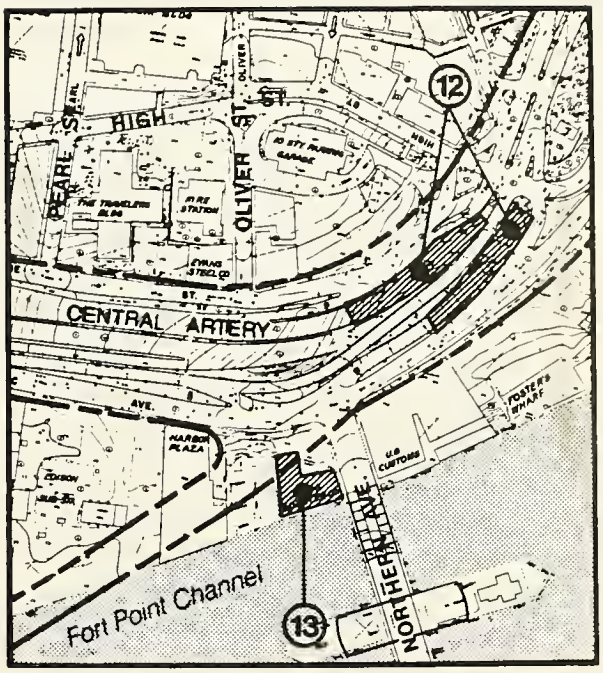
The Anelex Building (see Figure 26, #1) at 150 Causeway Street with 62 tenants and 2,200 employees, accommodates primarily office space on its upper floors and retail space at ground level. Approximately half of the tenants are public agencies and half are private businesses. The property also includes a 440-car surface parking lot in the back (see Figure 26, #1A).

The Boston Garden, located next to the Anelex Building on Causeway Street would not be taken; however, the Garden leases 39,200 square feet of space at the Anelex Building and depends on the availability of office and storage space. In addition, truck deliveries to the Garden pass through the Anelex Building via a ramp from the Anelex parking lot to the building's second floor and then through an enclosed above-grade passageway between the two buildings. The Anelex taking requires that relocation space and comparable delivery access be provided for the Boston Garden to ensure that none of its operations are disrupted.

The Anelex Building represents one of the largest concentrations of Class B/C office space (a rating which indicates that the building is old, does not offer "first class" office space, and therefore has more competitive rents) in the Central Business District. There is not a great deal of such space available at competitive locations to handle all of the required relocations from this building. However, there are a number of anticipated building conversions in less competitive locations which are anticipated, especially in the Fort Point Channel area and lower Washington Street. Other buildings in the North Station area are also being converted from current uses such as storage, showroom, or manufacturing space to office space. While there are no specific relocation areas in the North Station area to accommodate the 440 car lot, in the long term some of the spaces could be provided for by building a garage on State-owned property in the vicinity of Haverhill Street (above the MBTA Orange and Green Lines). In addition, Phase 1 of the North Station Development plans call for parking to serve the North Station area.

In addition, the building's largest tenant, the U.S. Coast Guard, is scheduled to move to the U.S. Customs Building on Atlantic Avenue upon completion of that structure's renovation. The Small Business Administration may also relocate to this building. An 11-story, 602,000





Legend

1	150 Causeway St.	Primarily Office, some Storage & Retail (62)
1A	150 Causeway St.	Parking
2	131 Beverly St.	Primarily Manufacturing & Warehouse
3	226 Causeway St. (Loading Dock Only)	Bakery Manufacturing & Distribution
4	Beverly St. Lot (proposed)	Parking
5	Haverhill St. Lot (1 of 2 parcels)	Parking
6	Causeway St. Lot	Parking
7	North Washington St. Lot	Parking
8	Cooper St./Stillman Place Lot	Parking
9	Endicott/Stillman Street Lot	Parking
10	N. Washington/Cross/New Chardon Street Lots (2)	Parking
11	Blackstone/North/Cross St. Lot	Parking
12	Purchase/High/Atlantic St. Lots (2)	Parking
13	15 Northern Ave.	Lobster Wholesale Retail

Note: Numbers in parenthesis indicate the number of businesses displaced, if more than one

Proposed Project Construction
Business Relocation
Approximate Tunnel Wall

Figure 26
Relocation Requirements
Area North of Dewey Square

0 200 400 Feet

7

EIS/EIR for I-90 –Third Harbor Tunnel; I-93 – Central Artery

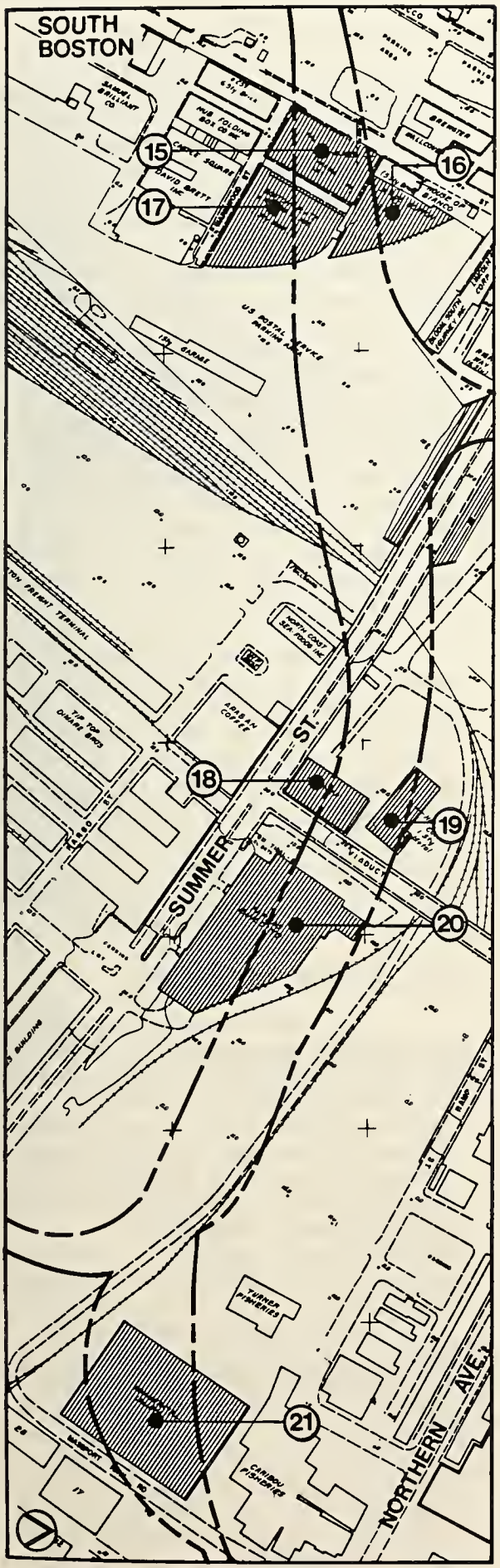
square foot (sf) federal office building, currently under construction at North Station, can accommodate other federal offices currently located in the Anelex Building. The Registry of Motor Vehicles may also relocate to the Registry's main facility at 100 Nashua Street in Boston in the future. The Registry and federal agencies with relocation options which include moving to government buildings, will reduce the amount of competition faced by tenants desiring to move to comparable space in privately owned buildings.

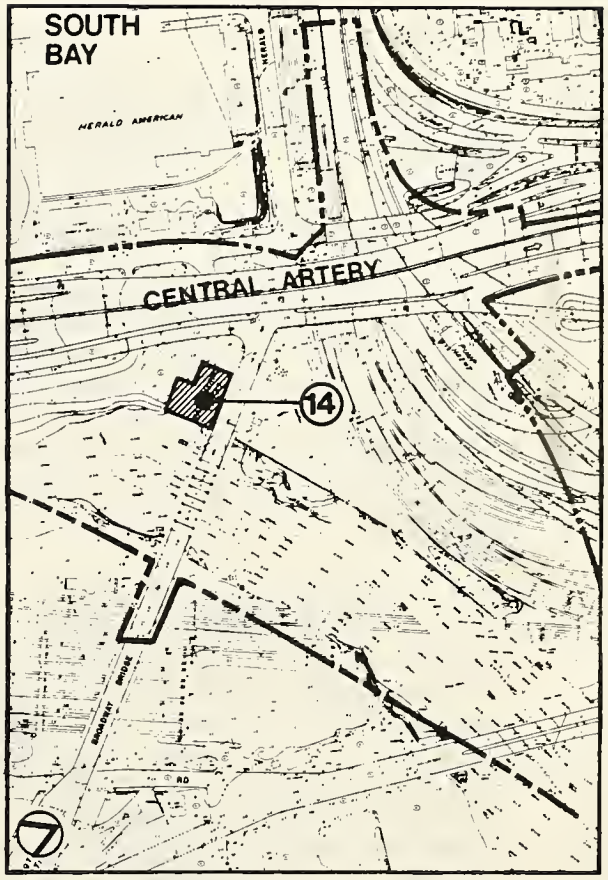
The Charles River Building (see Figure 26, #2) at 131 Beverly Street houses eight manufacturing or warehouse uses. Relocation space is available in Boston for Charles River Building tenants, since the market for mill-type industrial space in Boston is very active, especially in the South Boston/Fort Point Channel area.

The Stop and Shop Bakery (see Figure 26, #3), a manufacturer and distributor of bakery goods employing 300, is listed as a displaced business although it is too early to tell whether the property taking, which affects a small portion of the property, would ultimately lead to a business relocation. Stop and Shop has announced that the bakery will be relocated independently of this project. The building would be available for a number of other possible uses. The bakery utilizes the entire six-story facility at 226 Causeway Street in the North Station area for the manufacture of bakery goods and their region-wide distribution. With the exception of the one-story loading area, which juts out from the building's northwest corner, the remainder of the building itself would not be affected. The Two-Lane Tunnel Concept takes the one-story loading area. It appears, however, that an access road could be built from North Washington Street to the north of this building (using part of the present Charles River Building site), with a temporary loading dock area also provided in this area, which could permit the Stop and Shop Bakery to remain in operation. A truck maneuvering area would also be provided. If this were to be determined to be unacceptable to the Stop and Shop Co. during the design phase, then truck distribution of goods, a vital part of the business' operation, would be difficult or impossible during construction. Relocation of this businesss cannot be ruled out at this time, therefore, owing to the uncertainty of maneuvering large trucks in relocated loading area, and decisions by the owner regarding the suitability of the mitigating measures. There are a number of industrial sites, both freestanding and in industrial parks, to which the Stop and Shop Bakery might relocate. While there are few existing facilities or appropriate parcels upon which to build within the Route 128 area, numerous parcels are available throughout the Route 495 area which are appropriate and provide convenient regional access. As noted above, the Stop and Shop bakery is planned to be relocated independent of this project, and the building would be available for other uses.

Nine publicly-owned parcels used as parking lots (owned primarily by the City of Boston and also by the MDPW) would be taken below the Central Artery. About 30 employees would be affected (see Figure 26, #s 4-12). Parking lot operators run several lots or other businesses, so the possibility exists for employee transfers. Most of the lots are run by operators who bid for them on a yearly basis, and lease agreements stipulate a 30-day or 24-hour notice to terminate. Therefore, these employment opportunities are already short-term in nature. Refer to Section 4.4 LAND USE IMPACTS in the FEIS for a discussion on the Commonwealth's commitment to ensuring that comparable space for parking is made available.

Hook Lobster at 15 Northern Avenue, with 15 employees, is a lobster retailer and distributor (see Figure 26, #13). There is ample vacant land available with water





Legend

14	375 Broadway	Printer/Warehouse (2)
15	275 A Street	Parking
16	295 A Street	Fish Distributor
17	40 Wormwood St.	Glass/Metal Fabrication; Wooden Skid Manufacture
18	430 Summer St.	Manufacturer/Importer of Leather Goods
19	335 B St. Extension	Hoisting/Rigging Manufacture & Retail
20	440 – 450 Summer St.	Office/Manufacturing/ Warehouse (7)
21	30 Trilling Way	Warehouse/Manufacturing

Note: Numbers in parenthesis indicate the number of businesses displaced, if more than one

Proposed Project Construction

Business Relocation

Figure 27
Relocation Requirements
South Boston/South Bay Areas

0 100 200 400 Feet

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

frontage on Reserved Channel at King Industrial Park to accommodate Hook Lobster.

South Boston/South Bay Areas

The Rapid Service Press Building at 375 Broadway accommodates a printing and warehouse business employing a total of 75 employees (see Figure 27, #14). Businesses at the Rapid Service Press Building should be able to find comparable space within close proximity of their existing locations.

The Solomon Parking Lot has two part-time employees (see Figure 27, #15). Slade Gorton Company at 295 A Street (see Figure 27, #16) is a wholesaler and distributor of frozen fish with 65 employees. Boston Plate and Window Glass, which occupies a building at 40 Wormwood Street, is a glass and metal fabricator employing 15 people; a tenant at the same address produces wooden skids and employs two persons (see Figure 27, #17). The Harding Company at 335 B Street Extension, with 16 employees, is a supplier and manufacturer of hoisting and rigging equipment (see Figure 27, #19). Noymer Manufacturing Company at 430 Summer Street (see Figure 27, #18) has 75 employees who manufacture or produce leather goods. The Pappas Building at 440-450 Summer Street supports six tenants involved in office, sales, manufacturing, or warehousing and distribution activities (see Figure 27, #20). Jointly, 167 work at the Pappas Building. The Commercial Union Insurance Company at 30 Trilling Way with 67 employees, provides shipping, warehousing, and printing services for its Boston area offices (see Figure 27, #21).

There are a number of possible relocation resources for those office, manufacturing, processing, and warehousing concerns. Examples of space include vacant buildings on Summer and Wormwood Streets, such as 290,000 sf at the former Hub Folding Box Company on Wormwood Street (3 buildings); 90,000 sf of space at the Morton Shoe Building on Summer Street; approximately 800,000 sf now being leased by the Economic Development Industrial Corporation of Boston (EDIC) at the former Boston Army Base. Plans call for redevelopment of an additional 825,000 sf at Building 114 by one or more private developers at the Army Base under EDIC auspices.

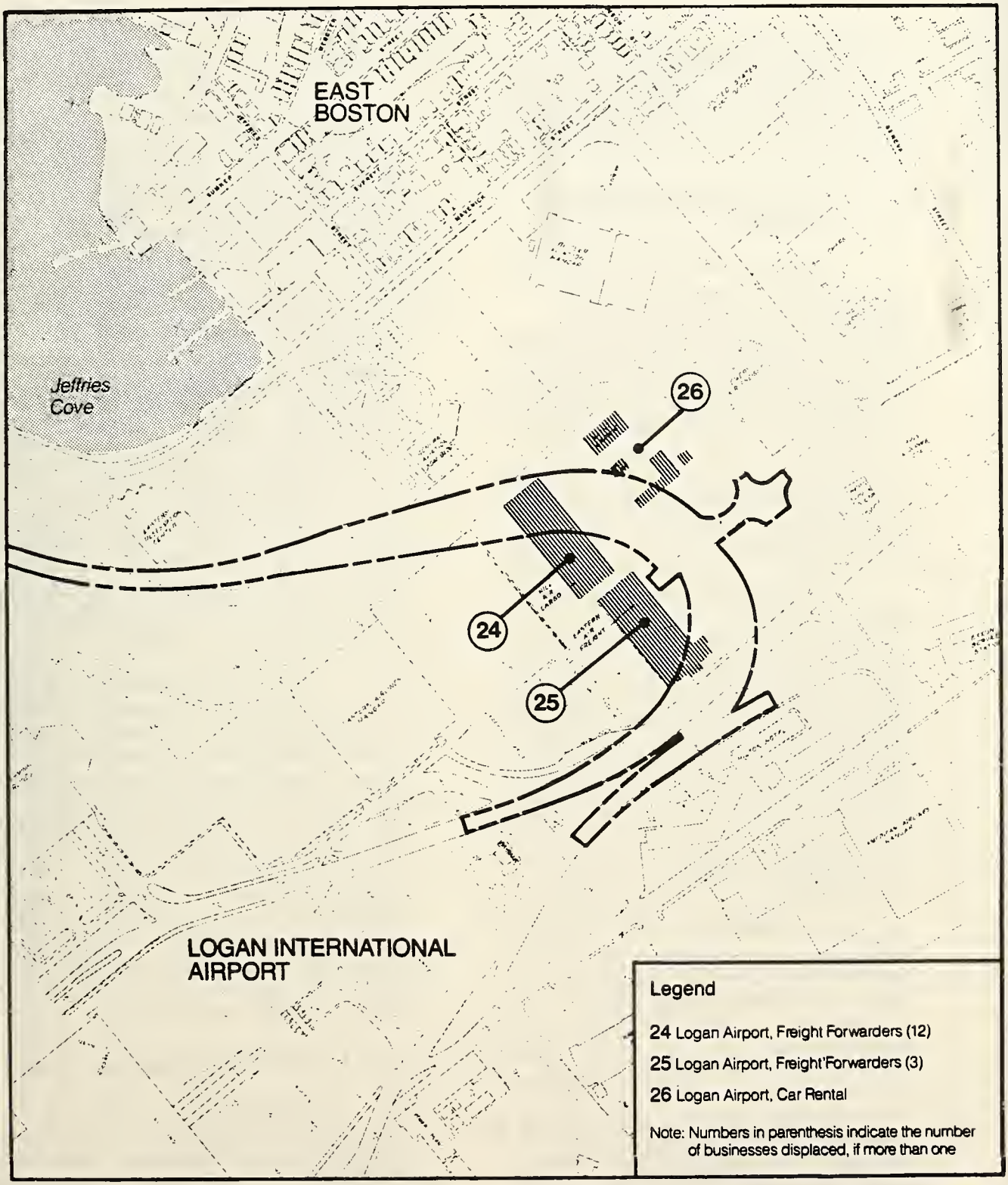
The Boston Marine Industrial Park and the Boston Army Base are owned by the Economic Development and Industrial Corporation of Boston (EDIC). During recent coordination meetings with EDIC, the agency has indicated that it would make every effort to find a place for businesses displaced by the project in one of their industrial parks or at suitable locations within the City.

However, there is currently no vacant land for sale or lease within the immediate neighborhood of Solomon Parking. The area is desirable to investors and speculators for future development, and parcels being held for development are already being used on an interim basis for off-street parking or other uses. It is unlikely that this business could be relocated within its present neighborhood.

East Boston/Logan Airport

At Logan Airport, the Eastern Air Freight Building (Figure 28, #25,) and Hill Air Cargo Building (Figure 28, #24) provide space for 15 businesses involved in some aspect of freight forwarding, jointly employing 184 employees. The National Car Rental facility (Figure 28, #26), with 120 employees, supports an administrative building, a facility for minor car repairs, and lot space.

Massachusetts Port Authority has stated a priority intention to facilitate the continued operation of affected Airport businesses on alternate sites on Airport property or other appropriately zoned industrial areas. Massport believes it has adequate space to accomplish this: 65 acres of land could be made available at Bird Island Flats (BIF); land in



Proposed Project Construction
Business Relocation

Figure 28
Relocation Requirements – Two-Lane Tunnel
East Boston/Logan Airport

0 200 400 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

the southwest section of the Airport is scheduled to become available in the future; and additional acreage is available on the north side of the Airport.

3.2.3 Related Business Economic Impacts

Despite the availability of replacement property and other relocation benefits which are discussed in Section 3.2.2, it is useful to note some particular concerns identified during interviews related to business displacement. It is difficult to do a more systematic analysis of the cost differential relocated businesses may experience because owners are reluctant to reveal their expense portfolios at the conceptual stage of such a project.

Longer-term property owners with favorable (if any) remaining mortgage payments would experience significant cost increases if they chose to construct a new building to specification. Present tenants with advantageous long-term leases would probably experience an increase in rents as a result of having to negotiate a new contract elsewhere. For example, Spencer Shoe has been in the Pappas Building since its construction in 1962; the business had a 20 year lease with a 16-year option to renew. Rent anywhere else would likely be significantly higher than current rent levels. Still other long-term renters who modified their properties may not be reimbursed for improvements unless specific measures were stipulated in lease agreements.

Impacts may be most severe for some of the manufacturing and warehouse businesses, many of them located in South Boston: Wardrobe Maker, Noymer, Harding, Slade Gorton, and Commercial Union Insurance Company. Unlike office furniture which can be moved quickly, manufacturing or warehouse businesses have heavy equipment or intricately stored material which cannot be moved easily, thereby creating the potential or likelihood for business disruptions during relocation. Possible halts in operations can be costly for individual businesses, and this type of loss is not covered by relocation benefits. These relocations are also very disruptive for businesses that ship nationwide and whose goods movement must be maintained while such a move is in progress.

Because such businesses contribute to the diversity of Boston's economic base, it may be important to consider the provision of special incentives to businesses to help them recoup any losses and to ensure that they relocate in the immediate area (which most of those interviewed appeared to prefer). This may be encouraged by specific initiatives taken at the city level such as tax abatements, low interest loans, and the provision of technical assistance. These options would be explored in the design phase.

It is also important to give as much notice as possible to businesses who would have to relocate. Based on interviews with the business representatives, it is estimated that at least 18 months to 2 years following property acquisition would be needed to carry out a timely and orderly relocation program. This time would be necessary to enable some of the businesses to negotiate land purchases or leases, to build to required specifications, and to schedule the move at a time when it will be least harmful.

3.2.4 Community Economic Impacts

Property takings of the Two-Lane Tunnel Concept, requiring the relocation of businesses along the alignment, would result in tax losses to the City of Boston. However, long-term impacts for the proposed project on local property taxes are estimated to include a $5-$10 million annual property tax benefit after full absorption of the air rights development that would be expected to become available above the depressed Central Artery. In addition, a $20-$30 million one time receipt (not

annual) would result because of a faster absorption rate of space in new South Boston developments (see Section 4.6 ECONOMIC IMPACTS in the FEIS/FEIR).

As indicated previously, it appears possible to relocate the loading area at the Stop and Shop Bakery to allow it to operate during construction. However, if the Stop and Shop Bakery relocates as recently announced, it would probably move to or build a more modern facility in Boston or along Interstate Route 495, leaving open the possibility of job losses among a portion of its 300 employees, 25 of whom are from the North End, 12 are from Charlestown, and 90 others are from different sections of Boston. Eleven percent of their work force is minority. Because the majority of employees are involved in labor intensive activities, some job loss would likely result because of automation. If the business were to relocate outside Boston, some employees may be unable to commute to the new location. Similar employment opportunities may be difficult to find in a city where manufacturing jobs are being replaced by service and other office jobs. In other instances, job accessibility for employees of other displaced businesses should be maintained as businesses can probably relocate in the same vicinity.

Of the nine parking lots taken under the Central Artery, the taking of the lot bordered by Blackstone, Cross, and North Streets may cause the most adverse economic impacts because of its convenient location to North End activities. If comparable space during weekdays is unavailable, some people may be discouraged from dining or shopping in this area upon removal of this lot. The Commonwealth is exploring other parking alternatives in order to avoid adverse economic impacts to this community. Plans for replacement parking are discussed in Section 4.4 LAND USE IMPACTS of the FEIS/FEIR.

For the remainder of the takings in the central area, South Bay, and South Boston, numerous locations accessible to the existing businesses are available; therefore, adverse economic impacts are not expected to result. In South Boston manufacturing and industrial jobs are actually expected to increase due to the current redevelopment of space at the Boston Army Base and due to roadway improvements built as a result of the Two-Lane Tunnel Concept. These improvements would also increase revenues in the long term.

In East Boston there are no significant community economic impacts because it is anticipated that most businesses would relocate at the Airport, thereby preserving existing jobs for East Boston residents.

Based on the relocation interviews conducted for this study, the number of minority-owned businesses to be relocated by the project is negligible. The percentage of minority employment at Logan Airport is lower than for the City of Boston as a whole. Business relocations at the Airport are not expected to affect a significant number of these employees. Minority representation in certain areas, however, is higher. In South Boston, the number of minority employees affected by relocation is approximately 16 percent of the total affected work force. This percentage is comparable to the total number of employed minorities who reside in the City of Boston (18 percent).

3.2.5 Massachusetts Department of Public Works Relocation Procedures

A business relocation agent would be assigned by the MDPW to assist each relocating business in all phases of relocation and in the preparation of documentation required to process payment claims. The relocation agents would inform all business owners of their benefits and entitlements, courses of action which are open to them, any special provisions designed to encourage businesses to relocate within the City, and other public or private

programs that may provide them with assistance.

Relocation Benefits

Depending on the type of ownership and the business options one chooses, displaced businesses are eligible for several payments:

1. Actual reasonable costs of moving and related expenses.

2. Direct loss of tangible personal property for items that are not moved and cannot be sold.

3. Actual reasonable expenses in searching for a replacement business, not to exceed $500.

4. A fixed payment in lieu of the payment for actual expenses and losses, not to exceed $10,000.

In addition, the property owners are reimbursed for the full fair market value of the business property. If any business or property owner has been denied a payment or disagrees with a computed amount, an administrative appeal process is available through the Hearing Examiner of the MDPW.

Functional Replacement

FHWA policies provide for functional replacement of publicly-owned facilities displaced by the project, where such replacement is in the public interest, as determined by consultation with FHWA. Functional replacement involves compensation beyond appraised market value of public property taken for highway projects if replacement cost exceeds appraised value. FHWA must approve actual replacement cost and review site selection design and construction.

3.2.6 Other Possible Sources of Assistance

Other potential resources to minimize economic harm to displaced business establishments, and to increase the likelihood of their remaining within city limits were explored. Sources contacted include State and local agencies, the Small Business Administration (SBA), Economic Development and Industrial Corporation of Boston (EDIC/Boston); Boston's Neighborhood Development and Employment Agency (NDEA); the Massachusetts Government Land Bank; and local banks. In some cases, the SBA will guarantee loans or issue a debenture in conjunction with other lenders.

Several other agencies have programs which could assist relocating businesses. These include:

- NDEA of Boston operates a program for retail and commercial businesses in nine targeted sections of Boston. For eligible businesses, the program provides loans at reduced interest rates for facade improvements or commercial development through participating commercial banks. This program also provides loan packaging and architectural assistance.

- EDIC/Boston assists in reviewing the financial needs of businesses, provides direct loan packaging assistance or referral to other financial assistance programs, and maintains listings on available industrial sites including parks developed by EDIC, and information on Boston's labor force.

- Massachusetts Government Land Bank can sell or rent space to businesses at below market interest rates. It may work directly with businesses or through EDIC/Boston.

In order to minimize inconveniences and impacts to businesses displaced by the project, the Commonwealth of Massachusetts would provide assistance to affected businesses in attempting to secure additional funds.

3.3 LAND USE IMPACTS

Mitigating Measures

Mitigating measures for the Two-Lane Tunnel Concept would be the same as those described for the Preferred Alternative in the FEIS/FEIR in most locations, see Section 4.4 LAND USE IMPACTS. The most significant differences would be found at Logan Airport where the Two-Lane Tunnel Concept would have very different impacts from the Preferred Alternative.

3.3.1 Regionwide

Long-term impacts of the Two-Lane Tunnel Concept on the region as compared to the No-Build Alternative may be noticeable in those areas where traffic service has been most seriously affected by delays on the Central Artery, and has inhibited development which might otherwise have occurred. The suburbs close to Boston, including Quincy, Milton, Chelsea, and Revere, may experience some marginal increase in development due to improved access to and through Boston. These communities may become somewhat more attractive locations for industries which depend on good highway access to Logan Airport, and for service industries which require fast access to downtown Boston (e.g., printing, office supply wholesalers, data processing). The high-tech industries located along Route 128 (Interstate Route 95) and Interstate Route 495 will also benefit from improved access to Logan Airport, although access improvements will not be as great as under the Preferred Alternative.

Large shifts in residential preferences are not likely to occur as a result of the project. Improved access to and through Boston may marginally affect the fluidity of the housing market in the Boston metropolitan area. In particular, easier access between northern and southern suburbs and downtown may influence household locational decisions by giving individual households greater choice in choosing where to live, as a result of making access to work a lesser constraint.

The depression of the Central Artery would create approximately 20 acres of developable land in downtown Boston. Based on urban design studies and structural considerations, it is estimated that this land could accommodate approximately 2.75 million square feet of development, excluding parking and open space. It is expected that new parcels would be developed for uses similar to those in abutting districts. This would have the positive effect of reconnecting those parts of the city previously separated by the elevated Central Artery. The pace at which this land would be made available for development would be controlled by the Commonwealth. Traffic generation from use of these parcels is included in the 2010 traffic forecasts as part of anticipated growth; economic impacts are addressed in Section 3.5 and Aesthetic Impacts are discussed in Section 3.10. Joint Development is discussed in Section 4.4.4 of the FEIS/FEIR.

The disposition of new parcels would be carefully regulated. Disposition would be consistent with the development controls outlined in Section 4.4.4 Joint Development of the FEIS/FEIR. Development of these parcels can have positive impacts, both locally and regionally, by insuring that there is a mix of uses serving a wide range of users, and reflecting the interests of those abutting neighborhoods most directly affected by the project.

Construction impacts would occur as a result of traffic congestion and inconvenience in downtown Boston.

Impacts on development are not expected to be noticeable at a regional scale, although traffic impacts would be greatly increased due to the lower capacity two-lane tunnel (relative to the Preferred Alternative).

3.3.2 Local Districts

Impacts on downtown Boston neighborhoods would be similar to those of the Preferred Alternative. See FEIS/FEIR Section 4.4 LAND USE IMPACTS for more detailed information.

South End

Long-term impacts on the South End industrial area would be somewhat improved over the No-Build Alternative, owing to improved access to the Airport for high-tech industries and developments. There are no land use impacts on the residential parts of the South End.

Construction impacts on the South End would result from increased traffic on Albany Street when the width of access ramps to the Southeast Expressway is reduced. The disruption in access would not be long enough in duration to affect land use.

Industrial Triangle

Long-term impacts are not likely; any changes would be positive owing to improved access to downtown and Logan Airport.

Construction impacts would result from congestion on Frontage Road and on the industrial section of Dorchester Avenue. Firms with marginal levels of business could be significantly affected when access is impaired during construction, possibly causing some changes in land use.

South Boston

Long-term impacts on land use would occur in two parts of South Boston: the industrial area north of First Street; and the South Bay area.

In the northern industrial area, the introduction of a tunnel to Logan Airport, which also serves as an Interstate-quality Seaport Access facility and provides direct access between northern South Boston and the Southeast Expressway/ Massachusetts Turnpike and the Airport, would have beneficial consequences on the timing and amount of development which occurs in the area as a whole. There are, however, a number of parcels on which the project would have a direct negative physical impact, resulting in changes in possible future use or delays in development (see Figure 29 and Table 23).

The development proposals which currently exist for northern South Boston fall into two broad categories: industrial development, and residential/commercial development oriented to downtown. In general, the industrial parcels are located in the eastern portion of the area, and the commercial or residential parcels are located closer to Fort Point Channel.

The Two-Lane Tunnel Concept would generally increase the value of land and may cause development of offices, hotels and condominiums to occur sooner than would happen without the project. The parcels near Fort Point Channel would benefit from improved regional vehicular accessibility, particularly from the expressway connections to the south and west, allowing less reliance on connections made via the Northern Avenue Bridge and Dewey Square.

In the industrial areas, the project would be of particular value to industries such as electronics and bio-medical enterprises which would benefit from improved Airport and regional highway access. Planned development of Bird Island Flats at Logan Airport and BOSCOM in South Boston is aimed directly at this

Table 23

SOUTH BOSTON LAND USE IMPACTS

PROPERTY OWNER/ CURRENT USE	TAKING	RELOCATION OF BUSINESS	APPROXIMATE AREA AFFECTED	SUMMARY OF IMPACTS
1. Gillette/surface parking, oil tanks	partial	No	13,000 sf open tunnel 19,000 sf over tunnel	Approximately 40 parking spaces permanently taken; no severe impacts on business.
2. Boston Wharf Co./ surface parking, development parcel	partial	No	11,000 sf open tunnel 54,000 sf over tunnel	11,000 sf of open tunnel cannot be used in the future. 54,000 over tunnel can be overbuilt, but will require foundation premiums. The project constrains use of large parcel.
3. Solomon/surface parking	full	yes, see Relocation Impacts	39,000 sf	Will be taken in entirety. Permanent easement for tunnel constrains use of parcel for buildings and would require foundation premiums. Parking use can occur following construction.
4. Slade Gorton fish distributor	full	yes, see Relocation Impacts	27,600 sf	Permanent taking; ramp and tunnel easement severely constrain future use of existing parcel.
5. Boston Plate & Window Glass/ manufacturing, warehousing	full	yes, see Relocation Impacts	49,700 sf	Subsurface tunnel easement constrains future use; surface parking could occur.
6. Post Office/ surface parking, vehicle maintenance	partial	no	290,000 sf total affected, 145,000 sf available post-construction	Permanent parking loss of approximately 340 parking spaces. A major parcel is permanently lost from other than highway use and the site is severed by a ramp. Parking can be replaced on other adjoining parcels following construction.
7. McCourt/surface parking	full	no	70,000 sf; 24,000 sf over tunnel or surface road	Parcel is reduced in size by 30% by roadway elements; access to the site from Congress Street is cut off, greatly reducing its value for future development, approx. 85 parking spaces lost during construction.
8. Conrail one live rail line, abandoned lines, vacant	partial	no	21,000 sf	The parcel will be permanently encumbered by a ramp and subsurface easements; use for rail line can continue at all times with permanent rail easement granted.
9. Contos property/ vacant	temporary, partial	no	50,000 sf (3,000 sf over tunnel)	Approximately 3,000 sf of the parcel will be permanently encumbered by subsurface easement. This will not affect long-term use of the parcel.
10. Former Penn Central land/vacant	partial	no	69,600 sf (surface road)	The taking will create a new surface street providing access to the tunnel; current plans for the land are for long-range office development; the project will have a positive impact in the long term.
11. Noymer, Inc.	full	yes	87,000 sf	A major part of the site will be permanently encumbered by tunnel elements.
12. Harding Co./ manufacturing	full	yes	42,000	The industrial user be displaced. Following construction, a significant portion of the parcel will be constrained by a subsurface easement.
13. Commonwealth Flats/ mixed use, vacant	partial	yes		Commonwealth Flats as a whole will have its flexibility reduced because no access across the parcel from Northern Ave.to Summer St. Specific parcel impacts are shown below.
A. Option Parcel I	no	no		Not affected
B. Option Parcel II	no	no		Not affected

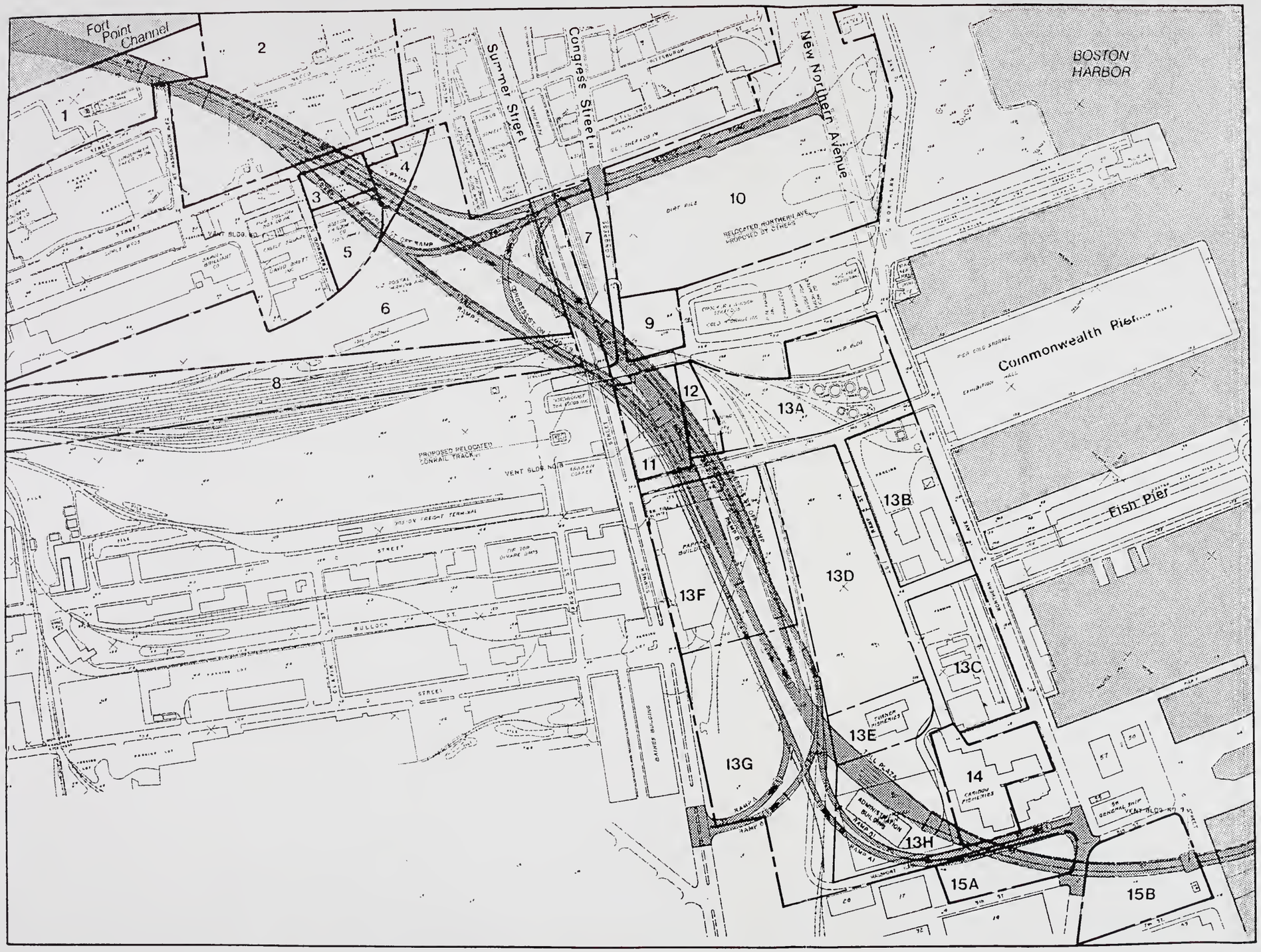


Figure 29
Land Use Impacts
South Boston

0 200 400 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Legend

Tunnel or New Roadway

Boundary of Affected Parcel Identified in Table 23

Table 23 (Cont'd.)

SOUTH BOSTON LAND USE IMPACTS

PROPERTY OWNER/ CURRENT USE	TAKING	RELOCATION OF BUSINESS	APPROXIMATE AREA AFFECTED	SUMMARY OF IMPACTS
C. Fish industries and restaurants	no	no		Not affected
D. Surface parking area	no	no		Minor taking by ramp. Adminstration building and parking.
E. Turner Fisheries	partial	no, mitigating measures required	20,000 sf taken	Loading dock and interior of building to be reconfigured to allow business to operate.
F. Pappas Building	full	yes	196,000 sf permanently encumbered	Building is taken and site significantly hampered by surface and subsurface project elements. Minimum parcel depth between Summer Street and project is 110 feet. (Total parcel is now 305,000 sf.)
G. Vacant area	partial	no	195,000 sf permanently encumbered	Potential use for storage and washing of imported cars, of existing 360,000 sf, more than half is permanently encumbered, this includes a parcel of 60,000 sf which will be landlocked by ramps and by parcels owned by others.
H. Commercial Union Insurance Company	full	yes	200,000 sf	The land to be taken will be permanently used by the project and will not be available for any other uses following construction.
14. Caribou Fisheries	temporary, partial	no	10,000 sf	Temporary taking to construct the tunnel, can be returned current use after construction.
15. BMIP				
A. Surface parking	temporary	no	35,000 sf	Temporary taking, following construction can be returned to existing use.
B. General Ship staging area	partial	no	35,000 sf temporary, 4,800 sf permanent	Temporary taking can be returned to current use following construction, 4,800 sf permanently taken for ventilation building.

market, and both of these developments will begin operating in 1984. The project may have significant positive impacts on BOSCOM by putting it within a few minutes drive of Logan Airport and Bird Island Flats, thus increasing the opportunities for "high tech" industrial development in this portion of South Boston. Improved access to the regional highway system may also enhance the development of container-port activities in South Boston.

Industrial land uses would be strengthened by improved access to Castle Island, White Fuel and other industries located on East First Street. Through trucks would be reduced on local South Boston streets, a significant benefit to residential land use.

Massport-owned Commonwealth Flats is a significant area of planned development. Construction of the tunnel would require the re-parcelization of this area, and would result in the removal of approximately 14 acres from future development use. Several large tenants would be displaced by the project (see Section 3.3), including the Pappas Building and the Commercial Union Insurance Company.

The northern half of Commonwealth Flats is currently planned to accommodate buildings and parking related to the BOSCOM development and the Fish Pier. The southeastern portion of the site, with access via the Massport Haul Road, is scheduled to be used for storage, parking, and washing of imported cars. The project does not intrinsically interfere with these planned uses; however, site circulation would require adjustments, and the total quantity of land taken for the project may require the construction of a parking garage to provide an adequate number of parking spaces on Commonwealth Flats. Parcel depth is sufficient from both Summer Street and Northern Avenue to accommodate development, but service access may be more difficult to achieve. Any changes in specific parcel configuration would be addressed in the preliminary design phase of the project.

There would be a permanent loss of 340 parking spaces at the U.S. Post Office parking and vehicle maintenance facility in South Boston. The primary access point to the facility would have to be relocated. The Post Office has plans to construct an operations/maintenance building on its South Boston property. The project would not preclude construction of this Post Office facility, but coordination of the siting and design of the new building with the project is necessary.

The project would not cause land use impacts which affect the long-term activities of the Gillette Company.

The project would not have long-term land use impacts on South Boston's residential area.

Construction impacts would include congestion caused by increased traffic, both in the northern industrial area and in the southern residential area. In the northern area, the temporary narrowing of the Summer Street and Congress Street Bridges, and construction on Northern Avenue and Summer Street, would cause congestion and impair access. This could temporarily slow development for the three to four year construction period. Sales at the commercial establishments and restaurants along the piers may also decline. In the southern area, the small stores near Broadway and Andrew Square may be similarly affected during the 12 to 18 month period when the Broadway Bridge is closed.

For approximately one year, construction activities would preclude General Ship, Inc., located at BMIP, from using several of its facilities, including Pier 5, a building used material assembly operations, the facility's steam plant, and parking areas.

Viaduct Street, between Summer

and Ramp Streets, would be closed for approximately 18 months. This would inconvenience BOSCOM and would require special provisions for a ground-level pedestrian entry from Northern Avenue.

The project would require the temporary taking of approximately half of a BMIP owned, 250-car parking lot for 12-18 months. BMIP tenants of Buildings 19, 32 and 17 would be affected by construction noise and dust; however, access to these buildings from Northern Avenue would be maintained at all times, and no disruptions in business activities would be caused.

Construction period loss of 460 parking spaces (in addition to the 340 spaces permanently lost) at the U.S. Post Office South Boston facility would occur. Construction period displacement of approximately 220 spaces on the Boston Wharf site and 130 spaces at the Solomon surface parking lot would also occur.

The 400,000 annual visitors to the Boston Tea Party Ship Museum and the Children's Museum would be sensitive to noise and air quality impacts during the nine to twelve month period when construction activities would occur in the portion of the Channel between the Congress Street and Northern Avenue Bridges. During construction, approximately 125 spaces would be temporarily displaced at the Gillette Company.

Fort Point Channel

Long-term impacts may result from increased accessibility to Logan Airport, which may encourage commercial development. These impacts would probably not be singularly decisive to the area's future.

Hook Lobster and the U.S. Customs Building would be taken and future development of these parcels would be constrained by permanent subsurface easements.

Construction impacts on the Fort Point Channel area involve temporary construction disruption caused by barges in the Channel and construction equipment along Summer Street, Congress Street, and Northern Avenue; and congestion on these streets and Atlantic Avenue due to temporary Fort Point Channel bridge narrowings and Central Artery construction. This may temporarily dampen the marketability of office space during the construction period and cause business losses to small commercial establishments.

Leather District

Long-term impacts would likely be beneficial owing to projected decreases of through traffic in the District.

Construction impacts on land use in the Leather District would consist of construction traffic and disruption, possibly causing delays in development activity.

Chinatown/South Cove

Long-term impacts would be positive, resulting from a reduction in traffic congestion on Kneeland Street, particularly during morning peak periods. The improvement in environmental conditions and pedestrian circulation may encourage the area's tourist trade and enhance Chinatown's viability as a residential community.

Construction impacts would include increased congestion at the Kneeland Street exit from the Massachusetts Turnpike and the Southeast Expressway. This increase in traffic may cause some short-term changes in pedestrian circulation and have some impact on business activities which are especially dependent on pedestrian access, such as the restaurant trade, but should not cause changes in land use.

Financial District

Long-term impacts would not cause significant changes in land use in much of the Financial District.

High-intensity office uses would continue to predominate in the Federal/Franklin Street area. Improved access to Logan Airport would be advantageous for existing and proposed developments. Although, because of the reduced cross-harbor capacity and subsequent higher traffic volumes on the Central Artery, congestion may continue to act as a barrier to regional accessibility. Access from the Central Artery to the Financial District would be slightly more restricted, especially for northbound traffic; this may re-route some traffic and result in some shifts in ground floor uses as the circulation paths of pedestrians shift to adapt to the new traffic pattern.

The removal of the elevated Central Artery would have impacts on land use along the edges of the Financial District. The physical barrier between the Financial District and the Waterfront would be removed. This would allow visual and functional connections between these two areas. Property values can be expected to rise, causing the displacement of marginal businesses and the redevelopment of parcels near the Central Artery for higher intensity uses. These parcels, and those created by the depression of the Central Artery, could house a variety of uses including office, retail, and residential. The re-establishment of the city street pattern which existed prior to the construction of the Central Artery, and the development of the new parcels, would strengthen the Financial District, and perhaps increase its diversity of uses.

The project may increase development pressure for Class A office space in the Broad Street area. Major redevelopment has not occurred in this area, in part due to the presence of the Central Artery. The physical characteristics of the buildings in this Historic District are protected. Change may come in the form of pressure for rehabilitation for luxury office reuse. It is possible that this rehabilitation and reuse may occur over the next 10 years even if the project is not undertaken.

Approximately 70 parking spaces would be lost due to the taking of the parking lot at Purchase Street/High Street/Atlantic Avenue. This may encourage the use of any vacant parcels for surface parking or add further pressure on development of parking structures across Fort Point Channel. The displaced spaces would be replaced.

Construction impacts would include traffic congestion and inconvenience due to street closings and re-routings. This may retard office development in the Broad Street area, and may slow the absorption rate for the new office space currently being developed elsewhere in the Financial District. Traffic congestion would be most disruptive to the area's few trucking-dependent businesses, most of which are in the Broad Street area or near the Central Artery. During the five-year period of open excavation work in this area, the construction activities would have negative effects on the quality of the environment.

Waterfront

Long-term impacts would result from the development of newly created parcels on air-rights over the depressed Central Artery. Land use on these parcels would be consistent with existing uses in the Waterfront area. Removal of the Central Artery would visually reconnect the Faneuil Hall Marketplace area with the rest of the Waterfront and the North End. The "Walk-to-the-Sea" would be established as a major component of the improved pedestrian environment. The setting of BRA Parcel D-10 would be enhanced by the project. New development parcels over the depressed Central Artery would be appropriate for buildings with commercial uses and parking on the lower floors, and office or residential uses on upper floors, similar to other buildings in the area. Decreased traffic along North Street would improve the environment around the Bostonian Hotel

and the rest of the historic Blackstone Block.

The Haymarket shopping area on Blackstone Street would be affected by the project. Areas crucial to its operation are located under the existing Central Artery, and would be taken when construction commences. Approximately 7,500 square feet under the Central Artery are used for pushcart storage when Haymarket is not open for business. In addition, 12 to 18 produce and fish trucks park under the Cental Artery on Fridays and Saturdays when Haymarket is open.

Traffic circulation in the area would be somewhat more circuitous for motorists on the northbound Central Artery who wish to go to the Quincy Market area.

Construction impacts would be significant. Construction period dust, noise, and traffic congestion would greatly reduce the quality of the pedestrian environment for tourists and other shoppers coming into the area. Waterfront businesses are very dependent upon tourists and other pedestrian customers. Business may suffer at area restaurants and stores, as a result of both actual and perceived parking and access difficulties, and the settings of the Bostonian and Marriott Long Wharf Hotels would temporarily become less attractive. The "Walk-to-the Sea" can be maintained physically during construction, but would be affected by dust where it crosses the construction zone. Business at Haymarket would be particularly disrupted as construction activities occur immediately adjacent to the outdoor vending area. Storage of pushcarts when the market is not in operation would also be a problem. Measures to mitigate these impacts are discussed in the FEIS/FEIR Section 4.4 LAND USE IMPACTS.

Government Center

Long-term impacts in the Government Center area would not be significant. Circulation around the area would be permanently changed, and some increases in congestion are expected. Development of BRA Parcel 7 may be delayed, and increased traffic at the intersection of the new southbound Surface Artery and New Chardon and Sudbury Streets could lessen the desirability of that location.

Construction impacts would result from traffic diverting onto side streets to avoid construction areas and from the loss of parking both under the elevated Central Artery and along the Surface Artery. Construction period noise and dust may affect activities in the proposed developments on BRA Parcel 7 and above the Government Center Garage.

North End

Long-term impacts on the North End cannot be determined with certainty. Two broad possibilities exist. First, that the removal of the Central Artery would spur a further rise in housing costs and conversions to condominiums in the community. Second, that improving the environmental quality of the area would encourage existing residents to stay, help to strengthen the neighborhood economy, and, therefore, reinforce the existing community. Both of these possibilities are described in some detail in Section 3.4 NEIGHBORHOOD AND COMMUNITY FACILITIES IMPACTS

Long-term land use changes will occur on the newly created air-rights parcels and near the entrance and exit areas to the existing tunnels. Some of these parcels will be smaller than those created with the Preferred Alternative. The newly created parcels and continuous street frontage will accommodate the development of land uses compatible with existing North End uses. The specific type and size of development will be determined during the preliminary design phase.

Construction impacts would include disruption to local businesses due to construction-related dust, noise, and traffic. Construction

period traffic pattern changes and the loss of parking under the Central Artery would make both pedestrian and vehicular access more difficult. Parking under the Artery would be replaced by the project. Construction disruption, particularly on Cross Street, may discourage people from coming into the North End and may make it more difficult for North End residents to get to the Haymarket MBTA Station. Construction would be particularly difficult due to the necessity of making four-way connections between the Sumner and Callahan Tunnels and the depressed Central Artery.

North Station

Long-term impacts in the North Station area may result from changes in the local traffic pattern. Access to the area to and from the north would improve due to new ramps at Causeway Street.

Access from the south, however, would become less direct due to the removal of the existing Causeway Street ramp. Traffic coming from the south would exit from the Central Artery to Leverett Circle and travel along Lomasney Way to gain access to the area.

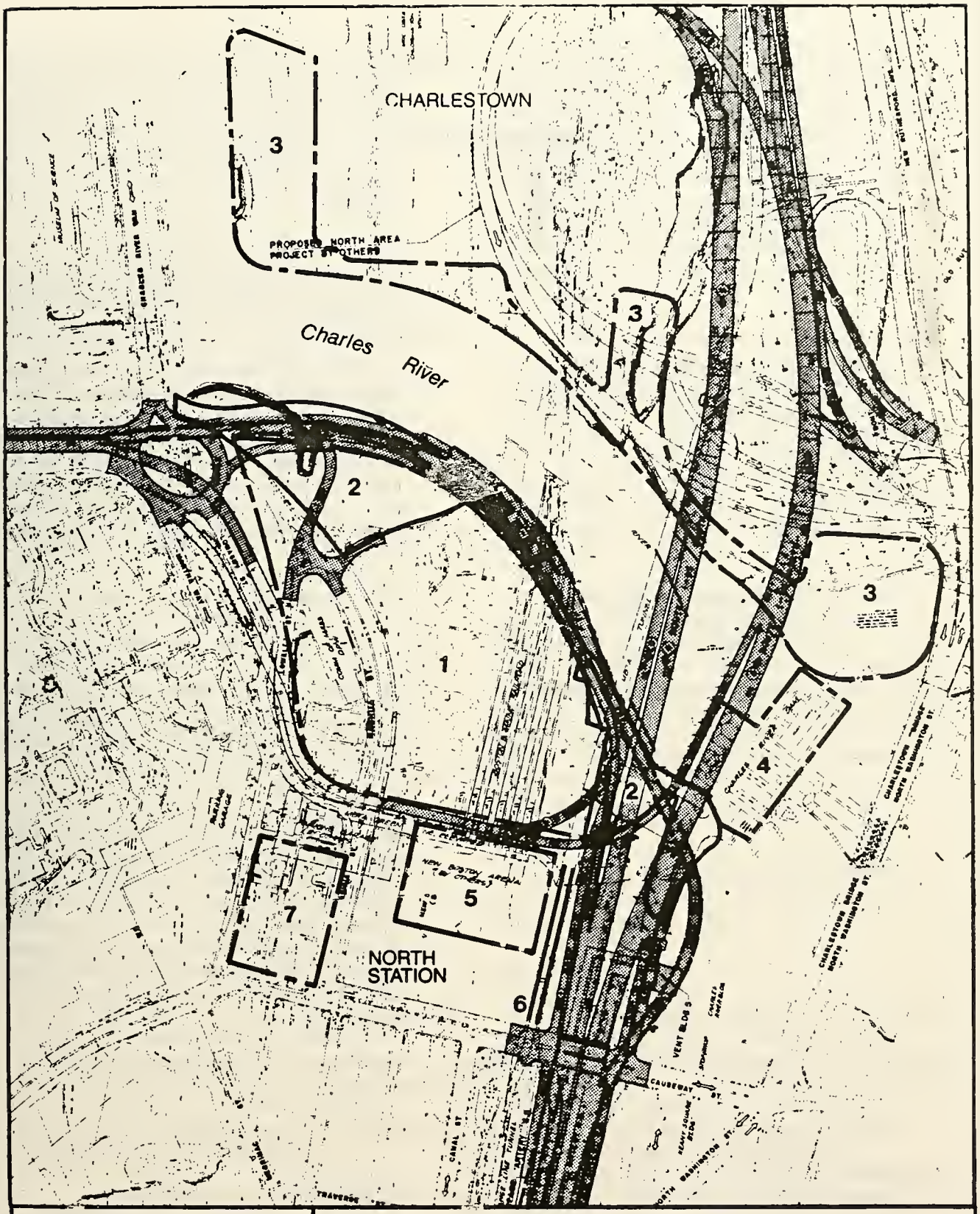
The project is not consistent with the BRA's proposed redevelopment plans for Subarea II of the North Station area or with the MDC's preliminary proposals for a continuation of the MDC riverfront park. It should be noted that these two major plans are not entirely consistent with each other, and that reconciliation would be required with or without the construction of the Two-Lane Tunnel Concept (see Figure 30 and Table 24).

The BRA's proposed canal, island and development parcels would have to be redesigned due to tunnel and ramp locations. Service access to a proposed arena would be diminished (see FEIS/FEIR Section 4.4.4 Joint Development). Below grade ramp connections would not allow the creation of a canal between the proposed arena site and the proposed island. Development on the proposed island is slated to be residential.

The MDC plan for the Boston side of this section of the Charles River proposes park use of land now occupied by parking lots for the MDPW, the Spaulding Rehabilitation Hospital, and the Anelex Building. The proposed MDC greenbelt along the river is currently interrupted by the MBTA's commuter rail tracks entering North Station. The Two-Lane Tunnel Concept would not prevent construction of public open space at the river's edge from the new Charles River Dam to the railroad tracks, but an open, depressed ramp, located approximately 35 feet inland would constrain the width of such open space. Upstream of the railroad tracks, the private parking area behind the Spaulding Rehabilitation Hospital would again be available for either parking or open space at the river's edge. Further upstream, an open depressed ramp rising to surface grade at Leverett Circle would block access to the river's edge. This area is now occupied by MDPW parking and is shown as open space (including an island and lagoon) in the MDC plan. This area would also be crossed by the relocated Nashua Street.

MDC open space plans on the Charlestown side of the river are not adversely affected by the Two-Lane Tunnel Concept. Impacts to the new Charles River Dam and the Paul Revere Landing Park are described in the Section 4(f) Evaluation in Section 3.11.

Access to the new Charles River Dam would be maintained via a replacement road built parallel to existing Beverly Street. Replacement of the High-Level Bridge with two, lower-level bridges would also have adverse visual, air quality, and noise impacts on the environment for pedestrians and bicyclists on the downtown Boston side of the Charles River in the vicinity of the new Charles River Dam. Impacts on this



Tunnel or New Roadway

Boundary of Affected Parcel or Identified in Table 24

Note: Areas are shown in approximate locations; exact boundaries are not known in all cases.

Figure 30
Land Use Impacts
North Station Area

0 200 400 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Table 24

NORTH STATION AREA LAND USE IMPACTS

	SITE	IMPACT
1.	BRA Subarea II	BRA's proposed canal, island, and development parcel would have to be redesigned due to tunnel and ramp locations.
2.	Proposed MDC greenbelt along Charles River, Boston side	Public open space along river edge from Charles River Dam to railroad tracks uninterrupted. An open depressed ramp rising to surface at Leverett Circle will block access to river's edge. Two low level bridges will have adverse visual, air quality, and noise impacts for pedestrians and bicyclists.
3.	Proposed MDC greenbelt along Charles River, Charlestown side	Not adversely affected.
4.	New Charles River Dam	Access will be maintained via new access road; walkway across dam will be adversely affected by shadows and noise from low bridge structure.
5.	Proposed new arena/garage	Building site not affected by the project, but service access as proposed would require modifications. Could supply replacement parking for that taken for the Central Artery project. If new complex not built, replacement storage space will have to be built to the rear of the existing Boston Garden due to the taking of the Anelex Building.
6.	Proposed Green Line relocation	Not directly affected by project.
7.	General Services Administration Office Building	Not directly affected by project.

MDC property are addressed in the Section 4(f) Evaluation in Section 3.11, and in Section 3.10 Aesthetic Impacts. The project would eliminate publicly owned parking under the existing elevated Central Artery, which could be replaced as part of a new Garden/Arena parking structure.

Takings which would occur in the area include the Charles River Building and the Anelex Building. The Stop & Shop Bakery loading area would be taken. Following construction the building would be available for reuse. Specific impacts due to these takings are described in Section 3.2 Relocation Impacts. The taking of the Anelex Building would require substitute space for Boston Garden storage and other support activities which currently take place within the Anelex Building.

The MBTA's proposed Green Line relocation and commuter rail improvements must be coordinated with the Two-Lane Tunnel Concept to assure that the two projects are compatible.

Long-term impacts on land use would include a reduction in the area's private office space which may result in a change in the area's character, although the General Service Administration's Federal Office Building will add considerably to the number of office workers in the area. The Anelex Building, Charles River Building, and Stop & Shop Bakery contain a significant portion of the area's work force. Removal of the Anelex and Charles River Buildings may change the character of long-term redevelopment of the North Station area. Removal of the elevated Central Artery may also provide impetus to upgrade existing structures, many of which are owner-occupied.

Navigability of the Charles River would not be affected by the project.

Construction impacts would result from a general increase in traffic congestion due to a construction staging area at the site of the Anelex Building, construction of the Storrow Drive connector ramps at the river's edge, and construction of the new Causeway Street ramp. The sequential closing and rebuilding of the ten railroad tracks into North Station would also be required. No loss of service would be caused, although minor delays in service are possible. The railroad spur to the Stop & Shop Bakery would also be removed.

Disruption due to construction of the Storrow Drive ramp connections would last 6 to 18 months, and involve traffic detours on local streets, principally Lomasney Way, Martha Way, and Causeway Street. Construction of the depressed Central Artery ramps would reduce the total number of lanes on Causeway Street by one-half for a six-month period.

During construction, some parking areas would be lost from the lots serving the Spaulding Rehabilitation Hospital, MDPW, and the Massachusetts General Hospital. When construction is complete, the lots can be restored to their original capacity, except for approximately 20 spaces at the MDPW lot.

West End

The Two-Lane Tunnel Concept would have no significant impacts on West End land uses.

East Boston

Long-term impacts would not be significant. There would be minor reductions in traffic on certain local streets, but they would not cause changes in land use. Access to downtown Boston would be somewhat easier than with the No-Build Alternative due to reduced congestion in the Sumner and Callahan Tunnels. This may marginally increase the attractiveness of East Boston for residential and related retail development. However, traffic in the existing tunnels would continue to be heavy, and there would be no access to East Boston via the Third Harbor

Tunnel without passing all the way through the Airport to gain access to the new tunnel ramps.

Construction impacts on residential areas would be slight, as all construction is restricted to airport property. Construction equipment would be restricted to the extent possible to state highways.

The second phase of Massport's Bird Island Flats development project (by others) should be completed by the start of tunnel construction in this area. That development has been designed to act as a buffer between the Airport and residential areas; it would also serve as a buffer during construction of the tunnel. All of the businesses that are displaced by the project are located on Massport property. Massport has stated a priority intention to relocate the businesses on Airport property, and would make specific offers to all affected businesses.

Logan Airport

Long-term impacts to Logan Airport would occur as a result of improved roadway connections to and from the south. This would reduce congestion on the main Airport roadways to some extent; however, there are no significant improvements to the operations of the Airport roadway system.

The circulation system would allow future development of a two-level roadway system at the Airport.

Construction impacts include the removal of the Eastern Airlines and Hill air freight buildings. Following construction of the project, these sites would be available for similar uses. There is adequate land and/or building area at Logan airport to relocate the occupants of these buildings in a manner consistent with the Logan Airport Master Plan, and they can be replaced in their existing sites following construction. Portions of the National Car Rental parcel would also be taken during construction.

The west satellite on the Eastern Airlines terminal (Southwest Terminal) would not be usable by large turbojet passenger aircraft for a period of approximately 15 months during construction, owing to the need to relocate the adjacent taxiway closer to the terminal during the construction of the tunnel in this tightly constrained area. The satellite can be used by smaller commuter aircraft during this period with adequate clearance for continued aircraft access to the Eastern Airlines hangar. The terminal can continue to operate normally by means of a temporary six-gate satellite (see Mitigating Measures below).

Minor detours of the Bird Island Flats access road would be required during three phases of the three-to-four year construction period. These detours would not significantly affect access to Bird Island Flats. Construction of air freight facilities and the Bird Island Flats mixed use development would not be significantly affected.

Minor disruptions to traffic on the main airport roadways and service roadways would occur during most of the construction period, but would not significantly affect airport service or operations.

Construction staging areas can be accommodated on sites temporarily taken for construction and on vacant land at Bird Island Flats. Construction vehicles would use a separate haul road parallel to the Bird Island Flats access road and would use airport service roads connecting to the regional highway system at Neptune Road.

Mitigating Measures

Mitigating measures would include traffic management to reduce disruption.

Construction would be staged,

and staging areas located, to avoid impacts on the Bird Island Flats development. The majority of excavated material would be removed from the Airport via a service road east of the tunnel alignment and would be trucked via Route 1A to disposal sites.

Disruption to Eastern Airlines passenger service, particularly the Shuttle service, can be avoided through construction of a temporary six-gate satellite in the center of the Southwest Terminal, facing Bird Island Flats; commuter service which currently uses this apron area can be relocated to the west satellite as described previously under Construction Impacts.

3.3.3 Joint Development

The joint development potential of the 20 acres of land in downtown Boston made available from depression of the Central Artery under the Two-Lane Tunnel Concept would be similar to the Preferred Alternative, with the exceptions in the North End subarea noted below. See Section 4.4.4 Joint Development in the FEIS/FEIR.

The addition of a northbound Central Artery connection to the Callahan Tunnel and a Sumner Tunnel connection to the southbound Central Artery would lessen the development potential of Parcels 10 and 11 by reducing parcel frontage, access and ground level parcel area. Also, the pedestrian connection linking retail activities in the Blackstone Block with those at Cross and Hanover Streets would be altered.

3.4 NEIGHBORHOOD AND COMMUNITY FACILITIES IMPACTS

Mitigating Measures

Mitigating measures for the Two-Lane Tunnel Concept would be the same as those described for the Preferred Alternative in the FEIS/FEIR in most locations; see Section 4.5 NEIGHBORHOOD AND COMMUNITY FACILITIES IMPACTS.

3.4.1 No-Build Alternative

Impacts of the No-Build Alternative on neighborhood and community facilities in the project area are discussed in the FEIS/FEIR Section 4.5.2.

3.4.2 Two-Lane Tunnel Concept

South End

Long-term impacts on community facilities for the Two-Lane Tunnel Concept are not anticipated relative to the No-Build Alternative. Intrusions of traffic in residential areas will not be greater than under the No-Build Alternative. Rotch Playground would not be affected.

Construction impacts of the Two-Lane Tunnel Concept would have little effect on community facilities and neighborhood cohesion in the South End. Some traffic increases are likely on East Berkeley Street during construction, marginally reducing quality of life.

South Boston

Long-term impacts of the Two-Lane Tunnel Concept are generally positive for residential portions of South Boston. By providing a direct, Interstate-quality Seaport Access system from the Southeast Expressway/ Massachusetts Turnpike/Central Artery, this concept would remove a significant number of through truck trips and commuter vehicles from South Boston's streets. However, lower levels of service (relative to the Preferred Alternative) in the Third Harbor Tunnel during the PM peak hour may discourage some trucks from using the new facility, and continued congestion on the Central Artery may cause some traffic diversions to local streets to continue. The access provided by this concept, however, is significantly better than that provided by the No-Build Alternative.

After the construction period, traffic volumes on A and D Streets would decrease; traffic on L Street would remain approximately the same as with the No-Build Alternative, or decrease slightly.

Construction impacts would be expected to occur in residential portions of South Boston. Dorchester and Old Colony Avenues, and A, B, and D Streets would experience traffic increases as a result of the 18 month closing of the Broadway Bridge, and disruption on the Central Artery and Frontage Road. Increased traffic at the Broadway/Dorchester Avenue intersection may affect access to the MBTA Red Line Broadway and Andrew Square Stations, both of which are key community facilities. The quality of life would be temporarily adversely affected on those residential streets which experience an increase in traffic, noise, and air pollution during construction.

Mitigating measures include traffic management and construction staging to minimize detours, and to prevent through traffic from detouring to residential streets.

Chinatown/South Cove

Long-term impacts would be positive as a result of a reduction in traffic on Kneeland Street. This would improve environmental quality for residents and visitors to Chinatown.

Construction impacts would occur because of increased traffic on Kneeland Street and at the intersections leading to and from the regional highways. This may cause some inconvenience to pedestrian circulation in the neighborhood. Actual construction activities in the immediate vicinity of the community would not be significant.

Waterfront

Long-term impacts would primarily be positive. Removal of the Central Artery structure would improve the pedestrian environment and reduce traffic-related air and noise pollution. The "Walk-to-the-Sea" would be greatly enhanced. Pedestrians walking along the waterfront on Atlantic Avenue would be afforded views of their destinations. Pedestrian access between various Waterfront attractions, as well as between the Waterfront and surrounding neighborhoods, would be improved as traffic on Atlantic Avenue would be reduced. Publicly-owned parking space taken by the project from both under and alongside the existing Central Artery would be replaced by the project. Tour bus parking would continue to be provided on public streets in the area.

Construction impacts, including dirt, noise, vibration and congestion, would reduce the quality of the pedestrian environment, and would be disruptive for area residents and tourists. Noise, dust, and traffic management mitigative measures would be performed to reduce these impacts. Increased traffic on Atlantic Avenue and Commercial Street would impair access to public facilities such as Christopher Columbus Park, the New England Aquarium and the Aquarium MBTA station. It would be more difficult for residents of the east side of Atlantic Avenue, and for tourists visiting waterfront attractions, to get to surrounding areas. Pedestrian access, however, would be assured during construction. As discussed in Section 3.3 LAND USE IMPACTS, the open-air Haymarket pushcart area, a community facility which depends on pedestrian access, would be affected by the construction.

The proposed ventilation building next to Harbor Towers would affect air quality in that area, depending upon the exact location of the building.

Government Center

Long-term impacts would result in more circuitous access to the area from the Central Artery. The elimination of the southbound Central Artery exit ramp at New Chardon Street would require drivers coming from the north to use the Causeway Street exit ramp and follow surface streets into the Government Center area.

Construction impacts would primarily be related to access. Confusion resulting from the relocation of access points and streets would be a problem for the many visitors coming into Government Center who are only slightly familiar with the area. Changes in street and traffic patterns would also inconvenience the MBTA and commuter buses coming in and out of Haymarket station. Construction-related noise and dirt would inconvenience the large number of pedestrians in the area.

North End

Long-term impacts include both actual physical changes and the perception by residents that the neighborhood has changed.

Removing the existing Central Artery structure would improve the western edge of the North End aesthetically. Pedestrian routes between the North End and other downtown neighborhoods would be more open and attractive. Traffic on Cross Street would decrease by approximately

50 percent. Convenient access between the North End and the Haymarket MBTA Station would be provided.

Predicting the ultimate impact of the physical and perceptual benefits of removing the Central Artery on the social fabric of the North End is very difficult. For a number of years, new private development and public improvements in the adjacent Waterfront area have been attracting new residents to the North End community, with resulting increases in housing costs and condominium conversions. A growing proportion of North End housing is less affordable by long-term North End residents. Development pressures on the North End are expected to continue in this direction independent of this project. Over the next decade, unless active policy intervention is undertaken by the City, these changes can be expected to continue and accelerate. The prospect of improved overall neighborhood conditions due to elimination of the viaduct may reinforce this trend. Conversely, commencement of a relatively extended construction period may dampen real estate speculation and pressures on the North End housing market. At the conclusion of construction of the depressed Artery, the improved environmental quality of the area may encourage existing residents to stay, help to strengthen the neighborhood economy, and, therefore, reinforce the existing community.

Business at North End restaurants and stores could improve as visitors to surrounding neighborhoods find it easier to walk into the North End. These businesses are an integral component of the community's ethnic cohesiveness. A depressed Central Artery and new cross-harbor tunnel would reduce traffic-related air and noise pollution in the area. All parking spaces which are displaced by the project would be replaced nearby so that lack of parking does not discourage visits.

A key variable affecting the direction of the North End community in this regard would be the actions of state and city government. Programs to assist long-term residents to continue to own or rent housing in the North End, condominium conversion and rent controls, public improvements targeted to the needs of existing residents, and parking and development controls, generally, are types of measures which would tend to stabilize the community with either the No-Build Alternative or the Two-Lane Tunnel Concept.

The state, in cooperation with the city, would ensure the adherence to sensitive development controls for adjacent air-rights joint development, and the participation by neighborhood residents in the planning process for such joint development. This would promote future joint development uses that are compatible with the North End neighborhood.

Construction impacts would be substantial for the entire construction period. A large number of residences, restaurants and food shops are located very close to the construction area, and would be particularly affected by construction period noise, vibration and dust. Open-air produce markets on Cross Street are particularly sensitive, and any loss in sales may be difficult for them to absorb. Local residents are dependent on these shops and have few neighborhood shopping alternatives. The state would sponsor programs for the maintenance of local businesses during construction, and would carry out measures to mitigate noise, dust and vibration impacts.

Street closings and traffic detours may exacerbate existing circulation and congestion problems. Access to other parts of the city would be impaired. Delays and less convenient bus service at Haymarket would pose a hardship for transit-dependent North End

residents. Traffic detouring via Commercial Street, to avoid the construction zone, would make it more difficult for neighborhood children to cross to the two large waterfront recreation areas. Traffic management programs to mitigate these impacts would be undertaken for the duration of the construction period.

The ventilation building to be constructed in the North End would affect air quality in the neighborhood. Further studies would be performed to determine the final location and configuration of the building so that air quality impacts on neighborhood residents would be minimized.

North Station

Long-term impacts on community facilities in this area would occur because changes in proposed development plans would be required (see the discussion of these impacts in FEIS/FEIR Section 4.4.3 Land Use Impacts).

Access to existing facilities such as the Boston Garden would be affected. Access from the north would be improved; however, access from the south would be more circuitous. Boston Garden's office and service facilities in the Anelex Building would be taken by the project, but replacement facilities would be provided, if a new Arena is not built in the interim. (If the new Arena is built, the replacement facilities obviously would not be necessary.)

Construction impacts include a loss of parking spaces, and difficult pedestrian access during some stages of construction.

West End

Long-term impacts would be minor. A smoother flow of traffic through Leverett Circle would improve air quality and reduce traffic-related noise at Charles River Park.

Construction impacts would result from the construction of the tunnel leading into Storrow Drive. Traffic congestion would increase as the connection from Storrow Drive to Interstate Route 93 is temporarily closed and traffic diverts to other streets. Increased traffic in this area would impair access to Massachusetts General Hospital, the Spaulding Rehabilitation Hospital, and the Massachusetts Eye and Ear Infirmary from the north for approximately 12 months. Construction period noise and dirt would be annoying to people using Charlesbank Playground for approximately three months. (See SECTION 4(f) EVALUATION for a detailed description of the impacts on this park.)

East Boston

Long-term impacts would be beneficial to the community. Reduced congestion and improved air quality relative to the No-Build Alternative, and somewhat improved access to downtown Boston (compared to the No-Build Alternative), would improve the overall quality of life for East Boston residents. Because of the lack of direct connections between the Two-Lane Tunnel Concept and Route 1A, however, the improvements in traffic conditions on local streets (and hence the improvement in quality of life in the neighborhood) is not as positive as with the Preferred Alternative.

Construction impacts would be insignificant as construction would not occur near residential areas, and construction equipment would be kept off local streets. East Boston Memorial Stadium would not be affected during construction.

3.5 ECONOMIC IMPACTS

This section highlights major economic impacts attributable to the Two-Lane Tunnel Concept.

Approach to the Analysis

The assessment of economic impacts is based on current and projected future economic conditions throughout the project area and Greater Boston Region (SMSA) and on changes in transportation service and accessibility attributable to each alternative, both during and after construction. Major economic issues thus include the following:

1. Impacts on the regional economy, which is affected significantly by through-trips on the Central Artery and by access to Logan Airport (Section 3.5.1);

2. Impacts on the project area economy (roughly, the Boston Central Business District (CBD) including the North End, northern industrial district of South Boston, Faneuil Hall/ Waterfront, West End/Government Center, Eastern Retail Core/Downtown Crossing, and the Chinatown/Leather District, the South End, and East Boston), which is principally affected by access to and from the highway system and local streets (Section 3.5.2);

3. Impacts on economic activities within specific subareas (noted above), which are primarily affected by truck and auto movements on local street, as well as access to and from the highway system (Section 3.5.3).

Another category of major economic impact addressed in this section includes development and related fiscal impacts (Section 3.5.4). Measures to mitigate anticipated adverse effects are highlighted in Section 3.5.5.

This analysis is based upon the characteristics of the regional transportation system, and the impacts of the various alternatives on this system, as discussed in Sections 3.1 and 4.2 of the FEIS/FEIR.

Section 3.4 of the Supplemental DEIS/DEIR, and the Supplemental Report on Land Use, Community Facilities and Economic Activities, contain information on baseline economic conditions for the overall study area, subareas, and specific economic sectors, and definitions of terms used and documentation of source materials.

Over 160 public and private sector officials from each major economic sector were contacted. Ninety-two (92) personal and telephone interviews were completed with officials representing 88,000 employees, or 43 percent of total study area employment. Freight forwarders and major users of air freight outside the immediate study area were also contacted. The results of these interviews, along with the relevant traffic and economic data, served as a basis for the following analysis.

3.5.1 Impacts on the Regional Economy

Long-Term Impacts

Completion of the Two-Lane Tunnel Concept would have, in varying degrees, beneficial impacts on the regional economy because it would provide better regional traffic service to Logan Airport, and for through traffic using the Central Artery, especially from the south and west, than exists in the long-term without the project. For regional auto and truck movements, the Two-Lane Tunnel Concept provides long-term benefits through improved Central Artery capacity as well as alternative cross-harbor routing possibilities (Third Harbor Tunnel). The Two-Lane Tunnel Concept would improve Central Artery throughput and downtown access somewhat due to the diversion of some of the south and westerly originating Airport-destined traffic through the new two-lane Third Harbor Tunnel.

The beneficial impacts of better regional traffic service also

would extend to a variety of economic user groups, including trucks engaged in essential commercial activities (8 - 14 percent of total vehicles on the regional network); employees; retail shoppers; and consumers of leisure; cultural, and entertainment resources. The No-Build Alternative will not improve regional traffic movements to and/or through the study area in the long-term.

Growth of high technology industries in particular over the past ten years has significantly increased the importance of time-sensitive access to Logan for regional economic performance (see Section 3.4 of the FEIS/FEIR for discussion of critical service and delivery requirements by industries, and of trends in air freight movements for international and domestic export from the region). Anticipated high-technology industrial growth in southeastern Massachusetts and northern Rhode Island also makes Central Artery accessibility to the south and west particularly important.

Traffic service to Logan Airport is expected to deteriorate over the long-term with the No-Build Alternative, and to improve somewhat with the Two-Lane Tunnel Concept. Improvements in time-sensitive access to Logan from completion of the Two-Lane Tunnel Concept can be expected to have a long-term beneficial effect on regional goods movement, and may positively influence business investment and employment throughout the region. Traffic service to Logan from the north of Boston with the Two-Lane Tunnel Concept would not benefit significantly because no changes are made to the existing Route 1A/Airport Access Road connections.

Access between the Boston Central Business District, where the regional financial industry is concentrated, and other parts of the metropolitan region, is heavily dependent upon the functioning of the Central Artery. Access to Logan Airport is particularly important to the financial industry and to certain service industries, as well as to the freight and parcel delivery firms which serve them. Included in these categories are bank check clearing functions (the earnings on which are highly sensitive to delivery times in and out of Logan), emergency hospital services, and small parcel shipments to and from a variety of business or personal service companies. These industries, as well as the manufacturing firms located to the south and west of the CBD, rely upon the availability of direct highway access to Logan Airport, and could be expected to experience some travel time (and cost) benefits with the Two-Lane Tunnel Concept because of the Third Harbor Tunnel.

The No-Build Alternative does not provide any comparable long-term benefits. Based on traffic projections for 2010, failure to improve Central Artery capacity and access to Logan Airport would result in increased travel times (ie, delays) and costs for regional movements to and through the project area. This could exert a long-term dampening influence on regional business investment (and employment) prospects.

Regional Economic Impacts from Construction Expenditures

Construction expenditures from the Two-Lane Tunnel Concept would generate industry sales, household earnings, and jobs throughout the regional economy. Impacts include the direct effects of construction labor and material purchases, plus the indirect and induced (or multiplier) effects of off-site material and labor inputs to these purchases. The Two-Lane Tunnel Concept would generate an estimated $3.4 billion in industry sales and household earnings and over 61,000 person-years of employment. The No-Build Alternative would have an estimated $65 million of direct, indirect, and induced industry sales and household earnings, and 1,100 person-years of employment. Net increased State income tax receipts from aggregate construction impacts of the Two-Lane Tunnel Concept would be

expected to total approximately $65 million.

Assuming construction labor requirements are fairly evenly distributed over the 12-year period, these requirements are not expected to significantly impact region-wide construction labor availability in any single year. Approximately 25 percent of these jobs are expected to be held by City of Boston residents.

Construction Period Economic Impacts

From the standpoint of the regional economy and for the reasons noted above, the Two-Lane Tunnel Concept's most significant construction period impact would be on access to and from Logan Airport, particularly air freight movements of certain manufactured and other products.

During construction, the Two-Lane Tunnel Concept would be expected to be somewhat disruptive to the regional economy because it would constrain access to East Boston, particularly during the estimated 24-month period when the Sumner/Callahan Tunnels' carrying capacity would be reduced by one lane (25 percent). Disruption of access to Logan Airport during construction would be minimized because the two-lane Third Harbor Tunnel would be expected to open prior to the partial closing of the Sumner/Callahan Tunnel. This would also divert south and west originating trips to Logan from the Central Artery. The No-Build Alternative would negatively impact regional person and goods movements during the three to four years that Central Artery capacity and service in that alternative is constrained; and impacts are expected to be more severe over this period for through-trip movements.

Certain industries, such as freight and parcel delivery establishments, emergency hospital delivery services, and time-sensitive businesses would experience travel time and subsequent cost increases during limited construction phases with either alternative.

3.5.2 Impacts on the Project Area Economy

Long Term Impacts

As presently configured, the Two-Lane Tunnel Concept marginally improves access to the CBD, owing principally to queuing effects of the one-lane limited off-ramp capacity. The reduction in options for getting on and off the Central Artery may also be problematical to certain CBD retailers because, even as local street traffic is expected to improve, routings would be more complex. Refinements to the current configuration, similar to the Preferred Alternative, would significantly improve this access.

Construction Period Impacts

With the Two-Lane Tunnel Concept, retail sales, goods movement, attendance at leisure-oriented facilities, and time-sensitive deliveries of public and private services within the CBD study area would be negatively affected during construction. However, the degree of disruption varies by economic sector and by location within downtown. The No-Build Alternative would also affect the above industries, although to a lesser extent, due to a shorter construction period.

The transportation industry within downtown, including freight forwarders, courier and other parcel services, would likely incur increased labor costs due to travel time delays, and possible capital costs as cumulative delays may force additional equipment purchases to assure reliable service.

The leisure and recreation industry, including museums, the Aquarium, movie theatres, and other cultural facilities, may experience some attendance and revenue declines during construction. Impacts would be primarily subarea specific, and may be

limited to those periods during construction when physical access and/or parking is temporarily disrupted or lost in the immediate vicinity of the facility. Construction staging and other techniques would keep such disruptions to a minimum.

Employee commuting by auto would be disrupted, but, with a few subarea exceptions, most employers would expect further diversions to mass transit or peak hour spreading, and therefore negligible impact on employee access.

Construction activities would likely dampen retail sales to shoppers, other than downtown employees, arriving in the study area by auto. Auto-dependent trips are characteristic of approximately 10-15 percent of CBD retail shoppers; auto-dependent retail sales throughout the study area are estimated to total approximately $225 million annually (including Lafayette Place, scheduled for completion in the summer of 1984), or approximately 27 percent of the $835 million estimated study area retail sales overall.

Retailers are concerned with actual physical disruption in patterns of access and travel times, as well as with the "perception" of difficulties by prospective customers, particularly in the case of comparison goods shopping (75 percent of all downtown retail sales). Retail sales losses during construction in the project area were forecast in a range of 2.6 to 5.0 percent of total study area retail sales (an annual total of $23 million to $45 million in constant 1982 dollars, or 10 to 20 percent of auto-dependent shopper sales). Construction staging and other techniques could be implemented to limit the retail sales losses toward the lower end of this range. Completion of Red Line and Orange Line extensions is expected to offset this loss in part by drawing additional suburban shoppers to the downtown.

3.5.3 Impacts on Subarea Economics

Long-Term Impacts

With the Two-Lane Tunnel Concept, traffic circulation patterns to Downtown Crossing retailers from the south and west would not be altered over the long-term, and traffic service is expected to improve as compared to the long-term No-Build Alternative. The provision of a continuous surface roadway above the Depressed Central Artery is expected to improve local distribution of traffic.

Between Faneuil Hall Marketplace and the Waterfront, the Two-Lane Tunnel Concept would improve visual and physical linkage. The overall improved appearance of the Faneuil Hall/Waterfront subarea should attract more people to the area for both leisure and shopping. The waterfront retail establishments, restaurants, and hotels would benefit from increased customer spillover from Faneuil Hall when the Central Artery elevated structure is removed.

Wholesaling and manufacturing would also benefit from improved access to the Airport. Travel times would decrease and wholesalers' customer base would increase slightly due to improved access to and from South Boston. The slight improvement of traffic flow and capacity on the Central Artery would also benefit these sectors.

Improved access to South Boston for the Two-Lane Tunnel Concept, coupled with improved access to the Airport, as compared to the No-Build Alternative, would make South Boston a more desirable location for manufacturing industries, particularly those using Airport services. Land values and prices would probably increase, possibly forcing a number of low-rent manufacturing tenants to leave.

Increased access to the South

End from the north and east for the Two-Lane Tunnel Concept would marginally improve the business climate in this area. Land values in the South End would not be significantly affected.

In East Boston, the increased Airport access from the south and west with the Two-Lane Tunnel Concept may reduce Airport-related land use pressure on the East Boston community.

Construction Period Impacts

Downtown Crossing

To and from the south and west, traffic to the retail core should not be significantly affected during the entire period of construction. Construction in the Dewey Square area would focus on the Fort Point Channel, and not along certain city streets used to get to the retail core such as Atlantic Avenue and Lincoln Street.

To and from the north and northeast, traffic would probably use the existing Central Artery, which would be maintained at six lanes during the construction period. During the final phases of new, depressed ramp construction, both the existing Central Artery and the six new lanes of the depressed Artery (open to through traffic) would be in operation. Traffic to the retail core which uses the Surface Artery from High Street to North Street would be negatively affected by construction.

Faneuil Hall/Waterfront

During the construction of a depressed Central Artery, access to Faneuil Hall would be constrained. During most of the construction period, the Surface Artery and Atlantic Avenue combined would provide six lanes for public use, in comparison to the present eight lanes. This would affect access to the Faneuil Hall area for those motorists coming from the south and west. Temporary construction roads (utilizing some right-of-way from both existing Atlantic Avenue and from the Surface Artery) would provide roadway service in the area; however, construction related delays can be expected. To and from the north, Faneuil Hall bound traffic would utilize the existing North Street on- and off-ramps, which would remain in service throughout most of the construction period. From the northeast, Faneuil Hall bound traffic would be constrained during the two year period of three-lane Sumner/Callahan Tunnel operation.

The disruption of traffic is significant to Faneuil Hall merchants because a significant proportion of their patrons (51 percent) arrive by auto. The combination of traffic disruption and loss of parking under the Central Artery could result in a loss of approximately 10 percent of potential sales at Faneuil Hall Market Place, or $8 million annually during construction. (This amount is included in the total expected losses noted above for the project area as a whole.) The provision of replacement parking for all parking lost would reduce this impact to some extent, depending on its exact location.

Patronage of Waterfront restaurants is directly dependent on a variety of pedestrian links from the Financial District to the Waterfront. Mitigating measures would ensure the maintenance of pedestrian access across the construction corridor.

South Boston

In the northern part of South Boston, restaurant patronage is highly dependent on auto access. At various times during construction of the Two-Lane Tunnel Concept, customer access would be somewhat constrained. Customer access to South Boston wholesalers would also be affected while bridges to South Boston are reduced in capacity.

South Boston has a large concentration of Boston's food processors, an industry with a high percentage of time-sensitive shipments. In particular, the seafood

industry is heavily dependent on access to and from Logan Airport. Longer travel times to Logan would increase costs to meet pick up and delivery schedules and would result in loss of business if customer orders could not be met on time. The seafood industry is also heavily dependent on truck shipments via the Central Artery.

Forty-seven (47) percent of all downtown printing establishments are located in South Boston. Approximately 10 percent of this industry's local deliveries are extremely time-sensitive. This work may be transferred out of South Boston during a short period of reduced access on the Summer and Congress Street Bridges for construction of the Fort Point Channel northbound tunnel. Further construction staging refinements would be explored to maintain full access on these bridges during construction.

North End

A high percentage of North End restaurant and food store patrons arrive by car, many after the evening rush hour. Parking is presently difficult in the North End. In order to prevent it from getting any worse during the construction period, replacement parking would be provided in convenient locations prior to the construction activity (see Section 4.4.3 in the FEIS/FEIR).

Chinatown/Leather District

The Chinatown/Leather District subarea has a high concentration of scientific and related instruments manufacturing. A significant portion, approximately 40 percent, of this industry's shipments go to Logan Airport. Although nearly all of these shipments are during off-peak hours, increased travel times to Logan during construction would increase costs. Negative impacts for the Logan Airport shipping aspects of this industry during the construction period would be minimized after the opening of the third harbor crossing.

South End

Increased traffic on Albany Street between Herald and East Berkeley Streets during construction would be expected to have only a marginal impact on business activities in the South End.

East Boston

Construction impacts in East Boston would largely be localized at Logan Airport and are thus not expected to affect overall East Boston business activities. Lane closures in the existing Sumner and Callahan Tunnels, however, could adversely affect traffic flow and economics in the toll plaza area. For a discussion of specific construction impacts on Logan Airport and related business refer to Section 3.3.2.

At Logan Airport, the Massachusetts Technology Center should benefit from the Third Harbor Tunnel over the longer term.

3.5.4 Development and Related Fiscal Impacts

Long-Term Impacts

The Two-Lane Tunnel Concept provides travel time and cost savings compared to the No-Build Alternative and would be a positive factor affecting long-term regional development, particularly to those industries requiring time-sensitive movement of manufactured and other products.

The Two-Lane Tunnel Concept would likely provide a positive stimulus to the overall project area due to the superior access that it affords the northern portion of South Boston. The No-Build Alternative may have a long-term negative impact on development activities, due to lack of overall traffic service improvements and increased congestion.

A major long-term net benefit from the Two Lane Tunnel Concept would

be the creation of roughly 2.75 million sf of air rights opportunities over the depressed Artery (excluding parking and open space). Based on preliminary urban design estimates of land use by office, commercial and residential categories, construction costs for the full air-rights program are estimated to total approximately $285 million (1983 dollars) and would generate 6,100 person-years of on-site construction employment. Total direct, indirect, and induced impacts of these construction expenditures on the regional economy would include an estimated $960 million in industry sales and household earnings, and 10,800 person-years of employment. Long-term jobs attributable to the office, commercial and residential land uses assumed for the full air rights program are estimated to total 9,400. These workers (and new residents) would be expected to generate an estimated $9-10 million annual retail sales within the project area.

In addition, as discussed in FEIS/FEIR Section 4.4, LAND USE IMPACTS, the introduction of direct access between South Boston and the Massachusetts Turnpike, the Southeast Expressway, and Logan Airport is expected to accelerate development in the seaport area of South Boston. The facilities provided by the Two-Lane Tunnel Concept are likely to increase land values in the seaport area, and to be of particular value to high-value, low-bulk industries which would benefit from improved Airport access.

Long-term impacts of the Two-Lane Tunnel Concept on local property taxes are estimated to include:

- A $5-10 million annual property tax benefit after full absorption of 2.75 million square feet of potential new air rights development that is assumed to become available over the Central Artery with the Two-Lane Tunnel Concept (over time, additional city property tax revenues could be realized as a result of general improvements in the project area environment); and

- A $20-30 million one-time receipt (not annual) because of faster absorption of space in new South Boston developments due to the Two-Lane Tunnel Concept.

As discussed in Section 3.3, a variety of areas where traffic service has been most seriously affected by delays on the Central Artery, including suburbs close to Boston (e.g., Quincy, Milton, Somerville, Chelsea and Revere) may experience some increase in development due to somewhat improved access to and through Boston with the Two-Lane Tunnel Concept.

Construction Period Impacts

During the construction period, the Two-Lane Tunnel Concept would not affect development activities on a regional scale, but rather would impact regional development activities by influencing the location, timing and pace of development within the study area.

Construction activities with the Two-Lane Tunnel Concept would affect the marketability of development projects in the immediate construction vicinity that are due to be completed during 1986-1991. New projects not located in the immediate construction area should only be marginally affected. After 1991, adverse impacts on Boston area development due to construction of the Two-Lane Tunnel Concept would diminish due to the opening of the Third Harbor Tunnel and the partial reopening of the Surface Artery.

Major construction period impacts would be concentrated in the Financial District/Waterfront (ZIP 02110) and the South Boston-North (ZIP 02210) subareas. In the Financial District/Waterfront subarea, Rowes and Fosters Wharf and the Fort Hill area projects would be nearing completion just as major construction under the Central Artery is beginning. With the

Two-Lane Tunnel Concept, both projects would experience added development complexities, and space would be more difficult to market due to the direct effects of construction activity. Redecking would have the least overall impact on development, but would disrupt selected developments within the immediate vicinity of construction to some extent. Construction activities with the Two-Lane Tunnel Concept could delay full rental of these projects by up to 1 to 1-1/2 years, but would not prevent their development.

In northern South Boston, initial construction disruption with the Two-Lane Tunnel Concept would be expected to slow down absorption of space in commercial, industrial, and residential properties that would be opening in the 1987-1990 construction period. During this time, South Boston would experience some loss of access (both locally and regionally) and it would become somewhat more isolated from downtown. During construction, the Two-Lane Tunnel Concept would have created a net benefit to South Boston by the year 1995. The No-Build Alternative should have little or no construction period impact on development in northern South Boston.

In East Boston, the Massachusetts Technology Center requires protection against potential noise and vibration impacts during construction to permit the full tenant absorption in Phases II and III of this development, and to avoid an adverse impact on overall leasehold and financing arrangements. Access roads for construction vehicles only may be required.

Construction period fiscal impacts could include short-term losses in city property tax revenues due to delays in development absorption. For example, the potential delay of up to 1 to 1-1/2 years in developing Rowe's and Foster's Wharf and the Fort Hill area with the Two-Lane Tunnel Concept could result in a one time $5 million tax loss.

The Two-Lane Tunnel Concept, in summary, would produce greater long-term economic benefits than the No-Build Alternative.

3.5.6 Measures to Minimize Adverse Effects

Section 4.4.3 of the FEIS/FEIR outlines a series of mitigating measures which are also relevant to the impacts discussed in this section. Among those measures, the items noted below are exceptionally important to mitigating economic impacts.

Impacts on the Boston CBD Economy

For both the Two-Lane Tunnel Concept and the No-Build Alternative, use of print, TV and radio media and highly visible signage to avoid confusion resulting from detours and temporary ramp closings, and to redirect traffic away from bottlenecks and sensitive residential areas, would be used.

Impacts on the Project Area Subarea Economies

Retail - The Two-Lane Tunnel Concept provides for the replacement of parking spaces lost underneath the Central Artery to mitigate adverse impact on Faneuil Hall Marketplace, North End and North Station area retailing and minimizes traffic detours and potential ramp closings on streets providing access to Faneuil Hall Marketplace and Downtown Crossing.

Waterfront Land Uses - Pedestrian thoroughfares underneath the elevated Central Artery would be maintained.

Manufacturing and Wholesaling - Access to surface roads and bridges (particularly to South Boston) would be maintained; advance publicity of any necessary street closings, together with suggested alternative

routes would be provided; and closings of important surface roadways would be restricted to non-working hours.

Fiscal and Development Impacts - Construction noise and staging activities as well as disruptions in service road access adjacent to any proposed developments in the immediate vicinity of the construction area would be minimized. Major losses in access due to detours and/or ramp closings, particularly in the 1987-1991 construction period would be avoided.

3.6 AIR QUALITY

The air quality consequences of the Two-Lane Tunnel Concept are presented in terms of their total emissions burden (mesoscale analysis), maximum one- and eight-hour carbon monoxide (CO) concentrations (microscale analysis), effects of toll plaza emissions, and tunnel ventilation, effects of ventilation building emissions, and impacts during construction. Where potential adverse impacts are identified, mitigating measures to alleviate these impacts are described in each of these impact categories. The Two-Lane Tunnel Concept impacts are compared to the No-Build Alternative impacts.

3.6.1 Mesoscale Analysis

This project is in an air quality nonattainment area for which transportation control measures are included in the State Implementation Plan (SIP) which has been approved by the Environmental Protection Agency. FHWA has determined that both the transportation plan and the transportation improvement program conform to the SIP. FHWA has also determined that this project is included in the transportation improvement program for the Metropolitan Area Planning Council Area.

However, as part of Massachusetts' consistency determination for a highway project (see Massachusetts Department of Environmental Quality Engineering, Appendix J, Transportation Project Level Guidelines), hydrocarbon emissions for the build alternative must be estimated and compared with the No-Build Alternative. If the emissions from the build alternative are lower than the No-Build, then the proposed project would have satisfied this hydrocarbon emissions criterion. If the emissions from the proposed project are higher than the No-Build Alternative, then all reasonable and feasible hydrocarbon mitigating measures would have to be included.

Two-Lane Tunnel Concept vs. No-Build Alternative

Using 24-hour traffic volumes on the affected network in the project area, emissions of CO, oxides of nitrogen (NO_x), and nonmethane hydrocarbons (NMHC) from all motor vehicle sources were estimated for the Two-Lane Tunnel Concept and the No-Build Alternative in 1990 and 2010, and also for the baseline (1982) conditions.

For both the Two-Lane Tunnel Concept and the No-Build Alternative, improvements in motor vehicle emissions will occur by 1990 and 2010 as a result of the Federal Motor Vehicle Control Program (FMVCP).

For the Two-Lane Tunnel Concept, 1990 NMHC emissions were estimated to be approximately 1 percent higher than the corresponding emissions from the No-Build Alternative. Daily vehicle miles of travel (VMT) and daily vehicle hours of travel (VHT) are expected to increase with the Two-Lane Tunnel Concept (when compared with the No-Build Alternative) on a regionwide basis (total travel within Route 128); the VMT within a smaller roadway network that is more focused on the Central Artery corridor (as used in the air quality analysis) was estimated to show a small increase. This is because with the improvement in capacity on the Central Artery, more traffic would remain on the Central Artery with the Two-Lane Tunnel Concept. NHMC emissions are expected to decrease with time as a result of the FMVCP. By 2010, Table 25 shows that NMHC emissions for the Two-Lane Tunnel Concept would be approximately 9 percent lower than the corresponding emissions from the No-Build Alternative.

Table 25 also shows the 24-hour emissions of CO and NO_x for both the Two-Lane Tunnel Concept and the No-Build Alternative. A trend very similar to NMHC would be expected for

Table 25

TOTAL 24-HOUR EMISSIONS OF CARBON MONOXIDE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS

Analysis Year	Alternative	Pollutants (kg/day) NMHC	CO	NOx
1982	Existing	4,230	60,200	6,520
1990	No-Build	1,810	39,500	4,610
	Two-Lane Tunnel	1,820	40,300	5,070
2010	No-Build	1,540	36,200	4,180
	Two-Lane Tunnel	1,400	33,500	4,480

CO. For NO_x, however, the emissions from the Two-Lane Tunnel Concept would always be higher than the No-Build Alternative. This is because when vehicles move at a faster speed (i.e., with less congestion) as in the Two-Lane Tunnel Concept (relative to the No-Build Alternative), the emission rates for NO_x increase.

Mitigating Measures

Since NMHC emissions in the region would be expected to be less with the Two-Lane Tunnel Concept than with the No-Build Alternative, no mitigating measures to reduce NMHC emissions are necessary with the Two-Lane Tunnel Concept.

3.6.2 Microscale Analysis

CO concentrations at selected receptor locations in the project area were estimated for the Two-Lane Tunnel Concept and the No-Build Alternative. No one-hour CO concentrations in excess of the 35-ppm standard was found. CO concentrations at all receptors were estimated to decrease with time except with the No-Build Alternative, where CO concentrations at heavily congested areas actually show an increase in 2010 after an initial decrease in 1990. There are a number of areas where eight-hour CO concentrations were estimated to be in excess of the 9-ppm standard in 1982. These violations would continue into the future with a No-Build Alternative. The excessive eight-hour CO concentrations anticipated for the area around the Sumner Tunnel portal would be alleviated with a new tunnel. With the Two-Lane Tunnel Concept, excessive eight-hour CO concentrations would be anticipated at Dewey Square and at City Square in Charlestown - although the problem at City Square is common to all alternatives. Compared with the No-Build Alternative, one- and eight-hour CO concentrations at most of the receptor locations analyzed would decrease with the Two-Lane Tunnel Concept either because of the removal of the motor vehicle emissions on the street (e.g., by depressing the Central Artery) or the diversion of traffic to a different and less congested corridor (i.e., with a new tunnel). CO emissions from the ventilation buildings would not contribute significantly to either the total one- or eight-hour CO concentrations.

Two-Lane Tunnel Concept vs. No-Build Alternative

Estimates of the maximum one-hour CO concentrations from all sources for the Two-Lane Tunnel Concept and the No-Build Alternative are shown in Table 26. No violation of the one-hour standard of 35 ppm was encountered anywhere. With very few exceptions, CO concentrations at all receptor locations examined show a decrease with the Two-Lane Tunnel Concept when compared with the No-Build Alternative. The geographical locations of the various receptors selected in this analysis are shown in Figure 31.

With the depression of the Central Artery, a significant portion of the emissions from the streets would be removed (and discharged through elevated exhausts in ventilation buildings). This removal is responsible for the significant reduction in CO concentrations at such receptor locations as the Quincy Market (Receptor No. 13) and Martignetti's (No. 14). A new harbor tunnel crossing would also relieve the existing congestion at the Sumner Tunnel portal in East Boston. Significant improvement in the air quality is therefore anticipated at such areas as Havre Street (No. 23) and Paris Street (No. 22) with the Two-Lane Tunnel Concept. Very little impact, in terms of changes in CO concentrations, is expected for receptors located either in the residential area or the industrial northwest section of South Boston.

When the Central Artery is depressed, the emissions from within the enclosed tunnels would be discharged through ventilation buildings. The effects of the vent

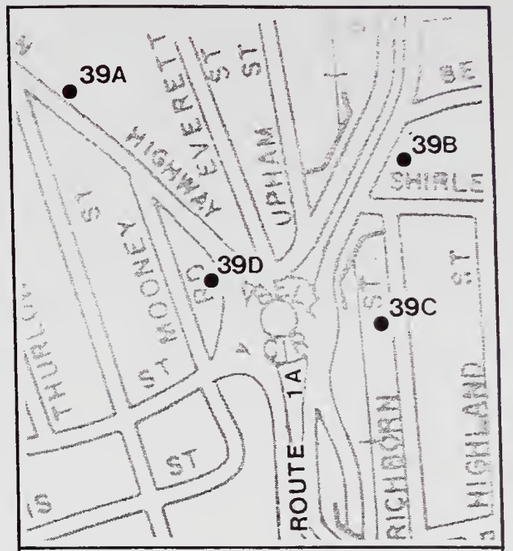
Table 26

ESTIMATED MAXIMUM ONE-HOUR CARBON MONOXIDE CONCENTRATIONS*
AT SELECTED RECEPTOR LOCATIONS

Receptor Locations	1982	1990 Alternatives No-Build	1990 Alternatives Two-Lane	2010 Alternatives No-Build	2010 Alternatives Two-Lane
1. Rotch Playground	17	13	12	11	10
2. Columbus Park	9	6	5	4	4
3. Res., Old Colony Ave.	10	7	6	6	5
4. Broadway Station	10	6	7	5	5
5. Tea Party Ship	12	10	8	9	7
6. Children's Museum	13	9	6	8	5
7. Reserve Bank	25	15	14	17	13
8. Stone & Webster	17	14	10	13	9
9. U.S. Postal Annex	13	10	7	9	6
10. CO Monitor - Kneeland	19	15	9	12	8
11. Tai Tung Park	16	13	9	11	7
12. N.E. Aquarium	15	10	6	9	5
13. Quincy Market	23	25	9	26	9
14. Martignetti's	21	28	10	29	10
15. Res., nr. Vent	15	13	6	13	6
16. Playgrd., Commercial	27	19	16	18	17
17. West End Apts.	16	12	9	7	8
18. Tennis Courts	21	14	14	14	12
19. City Square	29	22	21	21	21
20. Heritage Apts.	11	7	4	7	3
21. Maverick Square	15	10	5	11	5
22. Paris St. Health Ctr.	16	13	5	14	5
23. Res., Havre St.	33	23	6	28	8
24. Daniel Webster School	14	8	7	8	4
25. Day Square	13	7	6	6	5
26. Porzio Park	7	6	4	4	3
27. E. Bos. Mem. Stadium	12	9	5	5	5
28. Hilton Hotel	12	9	6	6	6
29. N. End. nr. Sumner Vent.	13	8	6	6	6
30. South Bay nr. Vent VO	9	6	6	6	5
31. Sumner/Cottage @ V2	9	5	4	4	4
32. Chelsea St. nr. Sumner Vent.	15	5	4	4	5
33. Central Sq., E. Boston	24	12	5	5	6
34. Atlantic Ave., nr. V1	19	14	11	14	11
35. 259 A St.	10	7	6	6	5
36 W. 1st & E. St	10	6	5	6	4
37. Summer & E 1st	10	6	4	4	3
38. BOSCOM	10	7	5	5	4
39. Mooney @ Bell Circle	12	8	8	8	7

*Concentrations are given in parts per million (ppm). The one-hr standard is 35 ppm. All entries include background concentrations of 4 ppm in 1982, 2.1 ppm in 1990, and 1.6 ppm in 2010. Concentrations are rounded to nearest ppm.

SOUTH END
MASS TURNPIKE I-90
Charles River
I-93
Mystic River
CHARLESTOWN
NST# 18
DOWNTOWN
NORTH END
MYSTIC TOBIN BRIDGE
SOUTHEAST EXPWY
CENTRAL ARTERY
Fort Point Channel
SUMNER TUNNEL
CALLAHAN TUNNEL
EAST BOSTON
ROUTE 1A
SOUTH BOSTON
BOSTON HARBOR
Reserved Channel
LOGAN INTERNATIONAL AIRPORT



Air Quality Receptor Locations—
Bell Circle, Revere

0 125 250 500 Feet

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

Figure 31
Air Quality Receptor Locations

0 900 1800 Feet

EIS/EIR for I-90 –Third Harbor Tunnel; I-93 – Central Artery

Numbers Indicate Receptor Location Identified in Text

NST #18 – From BRA North Station Study

emissions on maximum one-hour CO concentrations are quite insignificant - ranging from about 0.1 to 1.3 ppm. Contributions from these ventilation buildings to receptor locations in South Boston would typically be between 0.1 and 0.3 ppm; and in East Boston, the contributions would be between 0.2 and 0.4 ppm.

Table 27 shows the maximum eight-hour CO concentrations from all sources for the Two-Lane Tunnel Concept and the No-Build Alternative. Eight-hour CO concentration in excess of the 9-ppm standard are encountered in many areas throughout the project corridor under baseline 1982 conditions. These excessive CO concentrations would continue into 1990 and 2010 with the No-Build Alternative. With the Two-Lane Tunnel Concept, eight-hour CO concentrations would decrease at almost every receptor location examined. However, the CO concentrations for a receptor in the Dewey Square area (Receptor No. 7) and at City Square in Charlestown were estimated to be about equal to or slightly higher than the corresponding concentrations under the No-Build Alternative. Both of these concentrations are approximately 1 ppm over the 9-ppm standard in 1990. By 2010, no violation of the eight-hour standard is anticipated anywhere with the Two-Lane Tunnel Concept. With the Two-Lane Tunnel Concept, the eight-hour CO violations at Quincy Market (Receptor No. 13) and Martignetti's (No. 14) with a No-Build Alternative are eliminated. The bad congestion at the Sumner Tunnel portal and the resulting violation of the standard (e.g., the 14 ppm concentration for a receptor at Havre Street) with a No-Build Alternative would be alleviated with a new tunnel. The significant improvement in the air quality at this site is due to dramatic reduction in queue times at the Sumner Tunnel, especially in 1990. By 2010, however, the demand for the Sumner Tunnel with the Two-Lane Tunnel Concept would again lead to average delays of about 3.5 minutes per vehicle. Although the maximum eight-hour CO concentration for a receptor located near the tunnel portal (e.g., Receptor No. 23 on Havre Street) was estimated at about 4 ppm and therefore well below the corresponding 9-ppm standard, over 70 percent of this total concentration is attributable to emissions from the vehicles at Sumner Tunnel toll plaza. Eight-hour CO concentrations at various receptor locations in South Boston would be well below the 9-ppm standard with both the Two-Lane Tunnel Concept and the No-Build Alternative.

CO emissions from the ventilation buildings do not contribute significantly to the total eight-hour CO concentrations at any of the receptor locations examined. Contributions from these ventilation buildings to receptor locations in South Boston and in East Boston are in the range of 0.1 to 0.3 ppm. The maximum contribution of about 0.9 ppm was estimated for a receptor location at Atlantic Avenue (Receptor No. 34). The total eight-hour CO concentration at this receptor location is 7 ppm which is below the 9-ppm standard.

Mitigating Measures

No excessive one- or eight-hour CO concentrations were estimated for any of the receptors analyzed with the Two-Lane Tunnel Concept. If the Commonwealth's Inspection/Maintenance credits were included in the analysis, the concentrations would be reduced further. No mitigating measures would be necessary.

3.6.3 Effects of Toll Plazas

The effects of motor vehicle emissions at toll plazas are measured in terms of their potential for exceeding the eight-hour CO standard and the Massachusetts one-hour NO_2 policy level. A number of receptors in the proximity of the existing tolls in East Boston and the proposed toll plaza in South Boston were selected to monitor this impact.

Table 27

ESTIMATED MAXIMUM EIGHT-HOUR CARBON MONOXIDE CONCENTRATIONS*
AT SELECTED RECEPTOR LOCATIONS

Receptor Locations	1982	1990 Alternatives No-Build	1990 Alternatives Two-Lane	2010 Alternatives No-Build	2010 Alternatives Two-Lane
1. Rotch Playground	11	6	7	5	5
2. Columbus Park	6	3	3	3	3
3. Res., Old Colony Ave.	6	5	4	4	3
4. Broadway Station	6	4	4	3	4
5. Tea Party Ship	7	5	5	4	4
6. Children's Museum	7	5	4	4	3
7. Reserve Bank	10	8	10	8	7
8. Stone & Webster	11	7	7	7	5
9. U.S. Postal Annex	7	5	4	4	3
10. CO Monitor - Kneeland	13	9	6	9	6
11. Tai Tung Park	10	8	6	6	5
12. N.E. Aquarium	9	6	4	5	4
13. Quincy Market	11	10	6	10	5
14. Martignetti's	13	14	6	15	5
15. Res., nr. Vent	10	6	4	6	4
16. Playgrd., Commercial	9	7	5	6	5
17. West End Apts.	9	7	6	8	6
18. Tennis Courts	14	11	9	12	7
19. City Square	12	10	10	9	9
20. Heritage Apts.	7	5	3	5	2
21. Maverick Square	8	6	5	6	3
22. Paris St. Health Ctr.	9	7	4	8	3
23. Res., Havre St.	17	14	4	16	4
24. Daniel Webster School	6	6	4	7	3
25. Day Square	8	7	5	5	4
26. Porzio Park	5	3	3	3	2
27. E. Bos. Mem. Stadium	7	5	4	6	3
28. Hilton Hotel	7	5	4	6	4
29. N. End. nr. Sumner Vent.	9	5	4	4	3
30. South Bay nr. Vent VO	6	4	4	3	3
31. Sumner/Cottage @ V2	5	3	3	3	2
32. Chelsea St. nr. Sumner Vent.	7	4	4	3	3
33 Central Sq., E. Boston	11	8	5	8	4
34. Atlantic Ave., nr. V1	10	7	7	6	6
35. 259 A St.	6	4	3	3	3
36. W. 1st & E. St.	6	4	3	3	2
37. Summer & E 1st	6	4	3	3	2
38. BOSCOM	6	4	3	3	2
39. Mooney @ Bell Circle	8	5	5	4	4

*Concentrations are given in parts per million (ppm). The eight-hr standard is 9 ppm. All entries include background concentrations of 3.2 ppm in 1982, 1.7 ppm in 1990, and 1.3 ppm in 2010. Concentrations are rounded to nearest ppm.

Two-Lane Tunnel Concept vs. No-Build Alternative

For the Two-Lane Tunnel Concept, the toll plaza would be located in South Boston. Table 28 shows the maximum eight-hour CO concentrations from all toll plaza emissions for both the Two-Lane Tunnel Concept and the No-Build Alternative. The new cross harbor tunnel would reduce the average queue time for a vehicle during peak hours at both the Sumner and the Callahan Tunnels. In 1990, for example, the average delay at the Sumner Tunnel with the Two-Lane Tunnel Concept was estimated at about 0.3 minutes, which is significantly less than the corresponding delay of 10.8 minutes with the No-Build Alternative. For the new toll plaza in South Boston, the average delays for both the inbound and outbound traffic (assuming two-way toll strategy) were estimated at about 0.2 minutes. Because of these short queue times, the maximum eight-hour CO concentrations at all receptors examined would be less than 1 ppm. These concentrations are quite insignificant when measured against the corresponding 9-ppm standard. By 2010, however, the delay (for an eight-hour period) at the Sumner Tunnel with the Two-Lane Tunnel Concept would be expected to reach over 3.5 minutes. The eight-hour CO concentration resulting from this delay was estimated at over 3 ppm for a receptor located near the tunnel portal. While the total eight-hour CO concentration for this receptor location was estimated to be well below the 9-ppm standard, this 3-ppm contribution from the toll plaza represents a significant portion (over 70 percent) of the total CO concentration at this site. With the No-Build Alternative, excessively high eight-hour CO concentrations are anticipated for receptors that are located in the proximity of the Sumner and Callahan Tunnel portals in East Boston. For example, the 8.8 ppm estimated for the receptor on Havre Street represents a significant contribution to the 14-ppm total eight-hour CO concentration at this site (see Table 27). Impact from toll plaza emissions on eight-hour CO concentrations at the various receptor locations in South Boston would be insignificant (less than or equal to 0.9 ppm in 1990 and 0.2 ppm in 2010).

Table 28 also shows the effects of the toll plaza emissions on maximum one-hour NO_2 concentrations. Again, because of the short queue times associated with the Two-Lane Tunnel Concept in 1990, maximum one-hour NO_2 concentrations for receptors located in both East Boston and South Boston would be very low and well below the Commonwealth's policy level of 320 micrograms per cubic meter (ug/m^3). However, the increased delay at the Sumner Tunnel toll plaza in 2010 is expected to result in maximum one-hour NO_2 concentrations in excess of 190 ug/m^3 for a receptor located near the tunnel portal in East Boston. When a background concentration of 170 ug/m^3 is added to this toll plaza component, the resulting concentration of about 360 ug/m^3 would be in excess of the Commonwealth's policy level. With the No-Build Alternative, excessively high one-hour NO_2 concentrations are anticipated for receptor locations in the proximity of the existing tunnel portals in East Boston. For example, in 1990, toll plaza emissions alone will result in one-hour NO_2 concentration that is in excess of the 320 ug/m^3 policy level. No problem with respect to excessively high one-hour NO_2 concentrations is anticipated for receptor locations in South Boston either with the Two-Lane Tunnel Concept or the No-Build Alternative.

3.6.4 Tunnel Ventilation

Maximum one-hour CO and NO_2 concentrations in the various tunnel segments were estimated for both the Two-Lane Tunnel Concept and the No-Build Alternative.

Two-Lane Tunnel Concept vs. No-Build Alternative

Estimated maximum one-hour CO

Table 28

CONTRIBUTIONS OF TOLL PLAZA EMISSIONS TO MAXIMUM 8-HOUR CARBON MONOXIDE AND 1-HOUR NO_2 CONCENTRATIONS* FOR VARIOUS ANALYSIS YEARS

Receptor Locations	1982	1990 Alternatives		2010 Alternatives	
		No-Build	Two-Lane	No-Build	Two-Lane
8-Hr CO					
EAL Reservation Center	1.0	0.6	<0.2	0.8	0.2
Porzio Park	1.0	0.9	<0.2	1.1	0.3
BIF Park (proposed)	0.3	0.6	<0.2	0.9	0.3
Maverick Square	2.3	1.8	<0.2	2.4	0.7
Residents, Orleans/Porter	2.4	1.3	<0.2	1.6	0.5
Residents, Bremen/Porter	4.0	2.1	<0.2	2.6	0.7
Residents, Bremen/Gove	3.7	3.4	0.2	4.7	1.3
Residents near Sumner Toll	7.8	5.7	0.3	8.0	2.3
Residents on Havre St	11.7	8.8	0.4	11.5	3.2
Bldg @ 259 A St	<0.2	<0.2	0.3	<0.2	0.3
W. 1st & E Sts	<0.2	<0.2	0.2	<0.2	<0.2
Sumner & E 1st Sts.	<0.2	<0.2	0.2	<0.2	0.2
Boscom	<0.2	<0.2	0.3	<0.2	0.2
Pier 4 Restaurant	<0.2	<0.2	0.2	<0.2	0.2
Barnes Bldg	<0.2	<0.2	0.9	<0.2	0.2
1-Hr NO_2					
EAL Reservation Center	51	35	<10	63	18
Porzio Park	36	47	<10	56	16
BIF Park (proposed)	13	40	<10	53	15
Maverick Square	108	118	<10	171	48
Residents, Orleans/Porter	150	109	<10	152	43
Residents, Bremen/Porter	383	281	13	375	106
Residents, Bremen/Gove	189	242	11	359	101
Residents near Sumner Toll	293	296	14	486	137
Residents on Havre St	463	485	22	686	194
Bldg @ 259 A St	<10	<10	<10	<10	16
W. 1st & E Sts	<10	<10	<10	<10	<10
Sumner & E 1st Sts	<10	<10	<10	<10	13
Boscom	<10	<10	<10	<10	14
Pier 4 Restaurant	<10	<10	<10	<10	12
Barnes Bldg	<10	<10	<10	<10	19

*Concentrations are given in parts per million (ppm) for CO, and microframes per cubic meter ($\mu g/m^3$) for NO_2. These entries do not include background levels. The 8-hr CO standard is 9 ppm, and the state's policy level for 1-hr NO_2 is 320 $\mu g/m^3$. To compare with these standards and criteria, the 8-hr CO background concentrations 3.2, 1.7, and 1.3 ppm for 1982, 1990 and 2010 respectively, the 1-hr NO_2 background concentrations of 170 $\mu g/m^3$ (for sites in East Boston) and 224 $\mu g/m^3$ (for all other sites) should be added to these tabular entries.

concentrations in the various tunnel segments during peak hour traffic conditions and assuming all ventilation fans in operation are shown in Table 29 for both the Two-Lane Tunnel Concept and the No-Build Alternative. These concentrations range from about 17 to 52 mg/m^3 in 1990 for the Two-Lane Tunnel Concept. If a background CO level of about 2.4 mg/m^3 (corresponding to a 1990 background of 2.1 ppm) is added to these concentrations, the CO concentration in 1990 would range from 19 to 54 mg/m^3. These concentrations are acceptable and are within the ASHRAE guideline of 143 mg/m^3. Compared with the No-Build Alternative, CO concentrations in the Sumner, Callahan, and Dewey Square Tunnels would decrease dramatically with the Two-Lane Tunnel Concept. For example, the one-hour CO concentration of 62 mg/m^3 estimated for the Callahan Tunnel with the No-Build Alternative is expected to drop to about 28 mg/m^3 with the Two-Lane Tunnel Concept. This dramatic decrease is attributed to the major shift of the Airport-related traffic to the new cross-harbor tunnel.

Maximum one-hour NO_2 concentrations in the various tunnel segments were also estimated under the same set of peak hour conditions. The results are shown in Table 30. With the Two-Lane Tunnel Concept, the maximum one-hour NO_2 concentration in 1990 was estimated to range from 1,500 ug/m^3 (or 1.5mg/m^3) to 4,900 ug/m^3 (or 4.9 mg/m^3). When a background NO_2 concentration of about 224 ug/m^3 for the Boston segments and 170 ug/m^3 for the East Boston segments is added to the modeling predictions, the anticipated concentration in the tunnel in 1990 would range from about 1,720 to 5,120 ug/m^3. In 2010, these concentrations would be expected to decrease slightly in most cases, although in several segments the concentrations would increase due to the increased traffic volumes in the lower capacity two-lane tunnel. There are presently no ASHRAE guidelines or applicable standards governing maximum one-hour NO_2 concentrations in a tunnel environment. Under peak hour traffic conditions with all ventilation fans in operation, these one-hour NO_2 concentrations are lower than the NO_2 concentrations encountered in the existing tunnels in 1982. Like the CO case, maximum one-hour NO_2 concentrations in the Dewey Square tunnels are expected to decrease with the Two-Lane Tunnel Concept because of diversion of airport-related traffic to the new cross-harbor tunnel. While there is similar decrease in NO_2 concentrations in the Sumner and Callahan Tunnels, these decreases are not as pronounced as in the Dewey Square Tunnels.

Air quality in the existing tunnels, the new tunnels, and the depressed Central Artery is acceptable, based on the peak hour traffic conditions indicated in Section 3.1, and with ventilation fans in operation. However, should traffic conditions in the tunnels degrade, for example, due to an accident, and/or there is malfunctioning in the ventilation fans, then excessively high CO and NO_2 concentrations could result. To avoid this potential health hazard, the mechanical ventilation system of the proposed tunnels must be maintained in good working order at all times and a procedure for deploying the necessary number of fans in operation must be developed. Additionaly, a real-time CO monitoring system in the proposed tunnels must also be installed.

3.6.5 Effects of Ventilation Building Emissions

The effects of ventilation building emissions on ambient air quality were evaluated using two analytical methods: (1) EPA's ISC model for the "far-field" impact and using the same set of receptors that were used for the microscale analysis; and (2) Halitsky's algorithm for the "near-field" environment for receptors that are located at pedestrian sidewalk level in the immediate

Table 29

ESTIMATED MAXIMUM ONE-HOUR CARBON MONOXIDE CONCENTRATIONS* IN THE VARIOUS TUNNELS

Tunnel Description		1982	1990 Alternatives		2010 Alternatives	
			No-Build	Two-Lane	No-Build	Two-Lane
V0	Segments in South Bay	-	-	31	-	28
V1	Segments at Northern Ave	-	-	35	-	31
V3	Segments at Harbor Towers	-	-	40	-	31
V4	Segments at North End	-	-	27	-	20
V5	Segments at Causeway St.	-	-	52	-	40
V7	Segments at A and Summer St.	-	-	29	-	29
V8	Segments at Viaduct and Summer	-	-	17	-	20
V9	Segments at Naval Base	-	-	39	-	45
V10	Bird Island Flats	-	-	39	-	42
V11/V12	Segments - Sumner Tunnel	86	57	25	60	23
V13/V14	Segments - Callahan Tunnel	76	62	28	61	23
V15/V16	Segments - Dewey Sq. SB Tunnel	69	63	19	54	13
V17/V18	Segments - Dewey Sq. NB Tunnel	51	43	18	34	16

*Concentrations are in milligrams per cubic meter ($\mu g/m^3$). The ASHRAE guideline for one-hr CO concentrations is 143 $\mu g/m^3$. These maximum concentrations are based on design conditions and do not include background levels. To compare with the ASHRAE guideline, the one-hr CO background concentrations of 4.6, 2.4, and 1.8 $\mu g/m^3$ for 1982, 1990 and 2010, should be added to these entries.

Table 30

ESTIMATED MAXIMUM ONE-HOUR NITROGEN DIOXIDE CONCENTRATIONS* IN THE VARIOUS TUNNELS

	Tunnel Description	1982	1990 Alternatives		2010 Alternatives	
			No-Build	Two-Lane	No-Build	Two-Lane
V0	Segments in South Bay	-	-	2.7	-	2.4
V1	Segments at Northern Ave.	-	-	3.0	-	2.6
V3	Segments at Harbor Towers	-	-	3.8	-	3.3
V4	Segments at North End	-	-	2.6	-	2.1
V5	Segments at Causeway St.	-	-	4.9	-	4.3
V7	Segments at A and Summer St.	-	-	2.4	-	2.4
V8	Segments at Viaduct And Summer St.	-	-	1.5	-	1.7
V9	Segments at Naval Base	-	-	3.4	-	3.8
V10	Segments at Bird Island Flats	-	-	3.4	-	3.9
V11/V12	Segments at Sumner Tunnel	4.2	2.4	2.2	2.2	2.1
V13/V14	Segments at Callahan Tunnel	3.7	2.7	2.4	2.3	2.2
V15/V16	Segments at Dewey Sq. SB Tunnel	4.3	3.5	1.8	3.0	1.4
V17/V18	Segments at Dewey Sq. NB Tunnel	3.2	2.4	1.7	1.9	1.7

*Concentrations are in milligrams per cubic meter ($\mu g/m^3$). These maximum concentrations are based on design conditions and do not include background levels. To obtain total NO_2 concentrations in the tunnels, the one-hr NO_2 background concentrations of 0.170 mg/m^3 (or 170 ug/m^3) for East Boston segment(s) and 0.224 mg/m^3 (or 224 ug/m^3) for all other segment(s) should be added to these tabular entries. There are presently no ASHRAE guidelines or standards that apply to maximum one-hr NO_2 levels in a tunnel.

vicinity of the individual vents, and at air intakes on rooftops of adjacent buildings.

Two-Lane Tunnel Concept vs. No-Build Alternative

Far-Field Results

The effects of emissions from all ventilation buildings on the various receptor locations, using EPA's ISC model for the Two-Lane Tunnel Concept and the No-Build Alternative are shown in Table 31. The maximum one-hour NO_2 concentrations with the Two-Lane Tunnel Concept were estimated to range from about 14 to 125 ug/m^3 in 1990. With the exception of the receptor location on Atlantic Avenue (that has the 125 ug/m^3 concentration), the estimated concentrations from all of the other receptors do not represent any problem with the Commonwealth's policy level of 320 ug/m^3, even after a high one-hour NO_2 background of 224 ug/m^3 is added to the modeling results. Consequently, the maximum one-hour NO_2 concentrations at a number of receptor locations in Downtown Boston, the North End, and South Boston would increase with the Two-Lane Tunnel Concept.

In East Boston, changes in traffic volumes in the Sumner and Callahan Tunnels with the Two-Lane Tunnel Concept would result in lower NO_x emissions from the existing vent buildings and subsequent lower NO_2 concentrations at several receptors (such as Maverick Square) but several receptors also experience increases in NO_2 concentrations. Increased congestion on the Central Artery and in the Third Harbor Tunnel in 2010 would increase NO_2 concentrations at several receptors, although in most instances the maximum one-hour NO_2 concentrations would be lower than the 1990 concentrations. However, with the exception of the receptor at Atlantic Avenue, no concentrations in excess of the Commonwealth's policy level would be anticipated. The NO_2 concentration for the Atlantic Avenue receptor was estimated at about 330 ug/m^3, which is just over the policy level.

In 1990, the maximum one-hour CO concentrations at the various receptor locations with the Two-Lane Tunnel Concept were estimated to range from about 0.2 to 1.3 ppm. These concentrations are quite insignificant when measured against contributions from the mobile sources (see Section 3.6.2 Microscale Analysis) or the 35-ppm standard. The maximum eight-hour CO concentrations were estimated to range from about 0.1 to 0.9 ppm. These concentrations are also insignificant when compared with the 9-ppm standard. CO concentrations in 2010 are generally expected to be even lower. Consequently, no problem with respect to the one- and eight-hour standards would be anticipated in 2010.

Near-Field Results

The effects of ventilation building emissions in a near-field environment were assessed by considering one vent at a time and estimating the maximum one-hour concentrations for receptors at pedestrian sidewalk level and at air intakes on the roof of adjacent buildings. Table 32 shows the maximum one-hour NO_2 concentrations for each of the ventilation buildings with the Two-Lane Tunnel Concept and the No-Build Alternative.

The emissions from each of the ventilation buildings associated with the depression of the Central Artery (i.e., vent stack No. V0 through V5 in Table 32) are expected to result in one-hour NO_2 concentrations at nearby receptor locations that are in excess of the Commonwealth's 320 ug/m^3 policy level. For a number of receptors located at air intakes on the roofs of adjacent buildings, the estimated maximum one-hour NO_2 concentrations could reach over 900 ug/m^3 with background NO_2. For the new ventilation buildings in South Boston, maximum one-hour NO_2 concentrations in excess of the Commonwealth's policy level are also

Table 31

CONTRIBUTIONS OF VENTILATION BUILDING EMISSIONS ON ONE-HOUR NITROGEN DIOXIDE CONCENTRATIONS*

Receptor Locations	1982	1990 Alternatives		2010 Alternatives	
		No-Build	Two-Lane	No-Build	Two-Lane
1. Rotch Playground	44	32	23	27	21
2. Columbus Park	14	10	28	9	26
3. Residence - Old Colony Ave	27	20	30	17	27
4. Broadway Station	29	21	25	8	22
5. Tea Party Ship	28	22	26	18	24
6. Children's Museum	29	22	37	19	32
7. Reserve Bank	34	27	19	23	16
8. Stone & Webster	61	45	40	37	38
9. U.S. Postal Annex	43	34	22	29	19
10. CO Monitor - Kneeland	75	61	35	52	28
11. Tai Tung Park	67	50	35	43	30
12. N.E. Aquarium	46	35	28	30	24
13. Quincy Market	37	25	26	22	23
14. Martignettis	51	31	34	28	33
15. Residence Near Vent	124	72	80	66	78
16. Playground on Commercial	27	21	41	18	35
17. West End Apartments	16	13	19	11	17
18. Tennis Courts	12	9	24	8	21
19. City Square	32	20	41	18	36
20. Heritage Apartments	69	40	27	37	26
21. Maverick Square	83	48	29	44	28
22. Paris St. Health Center	42	25	22	23	20
23. Residence on Havre	49	33	40	29	35
24. Daniel Webster School	27	21	19	18	21
25. Day Square	25	17	17	15	15
26. Porzio Park	20	12	16	11	14
27. E. Boston Mem. Stadium	44	30	28	26	26
28. Hilton Hotel	12	8	17	7	20
29. North End, near Vent	41	28	48	24	41
30. South Bay near V0	37	28	65	24	58
31. Sumner/Cottage near V2	29	17	21	15	18
32. Chelsea St., near Vent	29	19	19	17	17
33. Central Square, East Boston	36	24	35	21	32
34. Atlantic Ave., near V1	33	23	125	20	108
35. Bldg., 259 A St	35	27	34	23	33
36. W 1st & E St	15	11	22	9	25
37. Summer & E 1st St	15	11	14	9	15
38. BOSCOM	23	18	30	15	26

*Concentrations are in micrograms per cubic meter ($\mu g/m^3$), and do not include background concentrations. The state policy level for one-hr No_2 is 320 $\mu g/m^3$. To compare with this policy level, a background concentration of 224 $\mu g/m^3$ for Boston sites, and 170 $\mu g/m^3$ for East Boston sites should be added to these estimates.

Table 32

EFFECTS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM ONE-HOUR NITROGEN DIOXIDE CONCENTRATIONS*
IN THE IMMEDIATE VICINITY OF THE VENTS

Stack Description	Receptor Location		1982	1990 Alternative		2010 Alternative	
				No-Build	Two-Lane	No-Build	Two-Lane
V0 @ South Bay	V0R1	Sidewalk	-	-	253	-	227
	V0R2	@ Gillette (SW)**	-	-	105	-	94
	V0R3	Bwy. T. (SW)	-	-	78	-	69
	V0R4	Post Office (R)	-	-	209	-	187
V1 @ Northern Ave.	V1R1	Sidewalk	-	-	281	-	242
	V1R3	Sheraton Bldg. (R)	-	-	336	-	282
	V1R4	Victoria Sta. (SW)	-	-	117	-	101
V3 @ Harbor Towers	V3R1	Sidewalk	-	-	322	-	276
	V3R2	Office @ High (R)	-	-	449	-	386
	V3R3	Harbor Towers (R)	-	-	388	-	332
	V3R4	Wkwy. @ Stella (SW)	-	-	161	-	138
V4 @ Callahan Tunnel Portal	V4R1	Sidewalk	-	-	248	-	207
	V4R2	Hanover/Cross (SW)	-	-	197	-	164
	V4R3	Bldg. @ Fulton (R)	-	-	294	-	246
	V4R4	Bldg. @ North (R)	-	-	329	-	274
	V4R5	Quincy Mkt. (SW)	-	-	133	-	111
V5 @ Causeway St.	V5R1	Sidewalk	-	-	464	-	402
	V5R2	Stop & Shop (R)	-	-	752	-	651
	V5R3	Kearney Sq. Bldg. (R)	-	-	568	-	493
	V5R4	Polcari's (SW)	-	-	233	-	203
V7 @ A and Summer Sts.	V7R1	Sidewalk	-	-	222	-	220
	V7R2	259 A St. (R)	-	-	274	-	273
	V7R3	Boston Wharf (SW)	-	-	108	-	107

*Concentrations are in micrograms per cubic meter ($\mu g/m^3$), and do not include background concentrations. The state policy level for one-hr NO_2 is 320 $\mu g/m^3$. To compare with this policy level, a background concentration of 224 $\mu g/m^3$ for Boston sites, and 170 $\mu g/m^3$ for East Boston sites should be added to these estimates.

**SW indicates sidewalk location, R indicates rooftop air intake location.

Table 32 (Cont'd.)

EFFECTS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM ONE-HOUR NITROGEN DIOXIDE CONCENTRATIONS*
IN THE IMMEDIATE VICINITY OF THE VENTS

Stack Description	Receptor Location		1982	1990 Alternative		2010 Alternative	
				No-Build	Two-Lane	No-Build	Two-Lane
V8 @ Viaduct & Summer St.	V8R1	Sidewalk	-	-	145	-	166
	V8R2	Barnes Bldg. (R)	-	-	88	-	102
	V8R3	Commonwealth Flats (SW)	-	-	36	-	41
V9 @ Naval Base, So. Boston	V9R1	Sidewalk	-	-	321	-	363
	V9R2	Boston Marine Industrial Park (SW)	-	-	105	-	119
V10 @ Bird Island Flats	V10R1	Sidewalk	-	-	220	-	254
	V10R2	BIF Park South (SW)	-	-	116	-	133
	V10R3	BIF Office Bldg. (R)	-	-	188	-	216
V11 @ North St., North End	V11R1	Sidewalk	183	106	201	98	196
	V11R2	St. Stephens (SW)	32	92	174	85	169
	V11R3	Res. @ Clark (SW)	35	102	194	94	189
V12 @ Liverpool, E. Boston	V12R1	Sidewalk	118	68	201	63	196
	V12R2	Res. @ London (SW)	116	67	198	62	192
	V12R3	Maverick Sq. (SW)	104	60	178	56	172
V13 @ North Sq., North End	V13R1	Sidewalk	139	100	87	86	78
	V13R2	Seamen House (R)	23	167	145	144	130
	V13R3	Bldg. @ North (R)	30	212	186	183	166
	V13R4	North Sq. (SW)	128	91	80	79	71
V14 @ Decatur, E. Boston	V14R1	Sidewalk	160	114	87	99	78
	V14R2	Paris Health Ctr. (SW)	150	108	82	93	73
	V14R3	Res. @ Decatur (SW)	157	112	85	97	76
V15 @ Beach St., Boston	V15R1	Sidewalk	203	163	69	141	55
	V15R2	Bldg. @ Beach (R)	389	313	131	270	106
	V15R3	Res. @ Beach (SW)	208	167	70	145	57
	V15R4	Rest @ Hudson (R)	416	334	140	289	113

Table 32 (Cont'd.)

EFFECTS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM ONE-HOUR NITROGEN DIOXIDE CONCENTRATIONS*
IN THE IMMEDIATE VICINITY OF THE VENTS

Stack Description	Receptor Location		1982	1990 Alternative		2010 Alternative	
				No-Build	Two-Lane	No-Build	Two-Lane
V16 @ Summer St., Boston	V16R1	Sidewalk	169	136	69	117	55
	V16R2	Bldg. nr. Vent (R)	309	248	125	215	100
	V16R3	Essex Hotel (R)	166	133	67	115	54
	V16R4	Dewey Sq. Bldg. (SW)	145	117	59	101	47
V17 @ Essex St., Boston	V17R1	Sidewalk	160	118	75	96	74
	V17R2	Bldg. @ Essex (R)	275	203	128	165	126
	V17R3	Dewey Sq. (SW)	153	113	72	92	70
	V17R4	Essex Hotel (R)	185	136	87	111	85
V18 @ Atlantic, Boston	V18R1	Sidewalk	188	139	75	113	74
	V18R2	Bldg. on Purchase (R)	292	216	116	176	114
	V18R3	S. Station (R)	222	164	88	133	87
	V18R4	Fed. Reserve (SW)	172	127	69	104	67

anticipated for receptors at pedestrian sidewalk level and rooftop air intakes in the proximity of these ventilation buildings. Similarly, the emissions from the ventilation building at Bird Island Flats in East Boston are also expected to result in NO_2 concentrations that are in excess of the 320 ug/m^3 for a number of receptors located in the vicinity of the ventilation building (even with the lower NO_2 background concentration of 170 ug/m^3).

One-hour NO_2 concentrations associated with the existing ventilation buildings in East Boston are not expected to be in excess of the Commonwealth's policy level with either the Two-Lane Tunnel Concept or the No-Build Alternative. Emissions from the existing ventilation buildings in the North End and in the Dewey Square area, however, would continue to result in maximum one-hour NO_2 concentrations that exceed the policy level. Because the Two-Lane Tunnel Concept is expected to result in a significant reduction in emissions from the ventilation buildings serving the Dewey Square tunnels, NO_2 concentrations at pedestrian level in the vicinity of these ventilation buildings were estimated to be below the Commonwealth's policy level. However, even with this emission reduction, NO_2 concentrations at a number of rooftop air intake locations were still estimated to exceed the 320 ug/m^3 policy level. Maximum one-hour NO_2 concentrations in 2010 were estimated to be only slightly lower than the corresponding 1990 results. Consequently, the problem of exceeding the Commonwealth's policy level in many areas would continue to persist.

Maximum one-hour CO concentrations at receptors located in the immediate vicinity of the ventilation buildings were estimated to range from about 2.5 to 10.0 mg/m^3 with background CO concentration in 1990 with the Two-Lane Tunnel Concept. These concentrations are well below the one-hour standard of 40 mg/m^3. The maximum eight-hour CO concentrations were estimated to range from about 2.0 to 7.2 ppm, with background. These concentrations are also within the eight-hour CO standard. Both maximum one- and eight-hour CO concentrations in 2010 were estimated to be less than the corresponding 1990 concentrations. Therefore, CO emissions from these ventilation buildings are not expected to be a problem with respect to exceeding the applicable standards.

If a one-hour NO_2 background concentration of 170 ug/m^3 is assumed for East Boston receptor locations, and 224 ug/m^3 is assumed for the rest of the study area in Boston (concentrations provided by DEQE), then emissions from most of the ventilation buildings analyzed - existing and proposed - would result in excessive one-hour NO_2 concentrations when measured against the Commonwealth's policy level of 320 ug/m^3. To mitigate this potential problem, a number of possible options must be fully evaluated. These options include: the height of the exhaust opening and/or the exit velocity of the exhaust gases could be altered to reduce the impact on nearby receptors; the exhaust gases from a given set of tunnel segments could be vented from more than one ventilation building in that general location (i.e., achieve a more diffuse source environment); the amount of exhaust gases could be reapportioned among the fixed set of ventilation buildings. Not all of these potential mitigating measures would be equally effective for all of the ventilation buildings. However, from the magnitude of these estimated one-hour NO_2 concentrations, it would appear that by using these mitigating measures - either individually or in some combination - the Commonwealth's policy level could be met at every receptor examined. The feasibility and effectiveness of these mitigating measures would be investigated in detail during the design stage.

CO emissions from the ventilation buildings are not a

problem with respect to either the one- or eight-hour standard. Consequently, no mitigating measures would be necessary.

3.6.6 Construction Impacts

The air quality consequences of construction are described in terms of the impact of traffic disruption during construction and dust emissions from construction-related activities and exhaust odor from truck emissions.

Two-Lane Tunnel Concept vs. No-Build Alternative

Increased traffic congestion and resulting high CO concentrations are anticipated during the construction period in a number of areas along the Central Artery corridor. This potential CO problem would apply to both the Two-Lane Tunnel Concept and the No-Build Alternative, because the No-Build Alternative would still involve redecking of the existing viaduct.

Because of the proposed alignment of the tunnel with the Two-Lane Tunnel Concept, aircraft operations at the Southwest Terminal would also be affected during construction. The potential impact - either in terms of changes in emissions or ambient concentrations at sensitive receptor locations in Jeffries Point - associated with this temporary change in airport operation would be expected to be insignificant.

Traffic Disruption

During the construction period, adverse traffic effects due to reduced capacity and detouring traffic would be anticipated for many locations in Boston, South Boston, and within Logan Airport. However, the details of the detour routing and the resulting traffic volumes on the affected roadway network have not been fully defined at this time. Consequently, the air quality implications of these traffic effects are examined qualitatively below - according to local areas.

- South Bay/Fort Point Channel Area

During construction of the tunnel segment under the Fort Point Channel, the existing bridges crossing the Channel would be closed sequentially. Traffic congestion would be anticipated at intersections of bridges (remaining open) with roadways parallel to the Southeast Expressway and the Central Artery. If the traffic congestion is severe during some stage in the construction period, the potential to exceed the 9-ppm CO standard would increase.

- Downtown Boston/Waterfront Area

During the construction of the depressed Central Artery, the overall capacities of the viaduct and the Surface Artery are expected to be decreased. This loss in capacity could lead to severe congestion on both the viaduct and the Surface Artery. This congestion, in turn, could result in traffic being diverted to Atlantic Avenue and to local streets in the downtown section of Boston. Both Atlantic Avenue and the local streets are presently very congested and there are severe CO problems at a number of locations along Atlantic Avenue. Therefore, diversion of traffic from either the Central Artery or the Surface Artery would be expected to result in increased congestion and exacerbate existing CO problem in this area. This problem is also applicable to No-Build Alternative, although the duration of construction is significantly less with the No-Bui Alternative.

During the first year of t construction of the Two-Lane Tunn Concept, utilities would be relo and traffic disruption would be anticipated on many of the cross streets. The traffic disruptio get worse during the constructi the slurry walls. During this parts of the Surface Artery an Atlantic Avenue would be close extensive detouring would resu combined eight lanes of capac

both the Surface Artery and Atlantic Avenue would be replaced by a six-lane surface roadway along the Central Artery; a 40-foot wide construction haul road would also be provided in this area. Increased traffic on the viaduct and on local streets such as Summer, Congress, High, Franklin, Federal, and Milk Streets would be overburdened. Adverse impacts on both one-hour and eight-hour CO concentrations would be anticipated as a result of this loss in capacity and detouring.

Construction of the Central Artery depression is expected to generate significant new truck traffic. For example, up to 1,000 trucks per day could be added to the surface streets during the excavation stage, further affecting local traffic, although the separate haul road would reduce the effect of this truck traffic on the local roads.

A similar effect on local traffic would also apply to the No-Build Alternative due to capacity restrictions on local streets below the Central Artery, as there would be more of a diversion from the viaduct to the local streets, as well as loss of some lanes of the Surface Artery, during the redecking process. This impact, however, would be partially offset by the shorter construction time for the No-Build Alternative.

o <u>North End/West End/North Area</u>

There are a number of areas in the North End (Hanover Street, the Callahan Tunnel portal, and Keany Square), the West End (at Leverett Circle), and at City Square in Charlestown that are known to have existing eight-hour CO concentrations that are in excess of the 9-ppm standard. Construction of the Central Artery depression or the redecking of the viaduct is expected to aggravate this existing problem. At some point in the construction of the Central Artery depression, removal of the southbound Central Artery off-ramp to Storrow Drive would result in traffic being diverted to Lomasney Way and Causeway Street. Increased congestion on the local streets could ensue, leading to an exacerbation of the CO problem in this area.

During the construction of ramps and related improvements at Leverett Circle, capacity of the Circle is expected to be reduced by one-third. The Leverett Circle area is presently in violation of the eight-hour CO standard. Reduction in capacity would in essence extend the "peak" hour period in both the morning and evening peaks. This would aggravate the existing eight-hour problem.

o <u>South Boston</u>

The Summer Street bridge over the railroad tracks would have to be re-built in both the No-Build Alternative and the Two-Lane Tunnel Concept.

During the construction of the cross-harbor tunnel, Viaduct-Ramp Street and portions of B and Congress Streets would be closed. These replacements and closures would lead to traffic diversions to other streets, principally in the northern industrial section of South Boston. Because the traffic volumes on these streets are generally not very heavy, no serious congestion and CO problems would be anticipated as a result of this diversion. Potential problems, however, would be expected at the various Fort Point Channel bridge crossings.

o <u>East Boston</u>

The construction of the Two-Lane Tunnel Concept would not have any significant adverse traffic effects on the local streets in East Boston. Most of the impact would be felt within Logan Airport. This impact is described in a subsequent subsection.

<u>Dust Emissions and Exhaust Odor</u>

Dust and truck exhaust emissions at construction sites,

staging areas, and along truck routes can lead to potential adverse effects (as manifested in nuisance dust, odor, and possible violation of the 24-hour total suspended particulate Federal and State standards). The construction sites along the Central Artery corridor are located in a very urbanized area with extensive public access and with many public amenities, such as Quincy Market and the restaurants along the waterfront. The potential problems associated with nuisance dust and truck exhaust odor would detract from the enjoyment of these amenities. These problems are equally applicable to both the Two-Lane Tunnel Concept and the No-Build Alternative.

Staging areas in the Central Artery corridor (e.g., at the Anelex Building, or the parking areas by Causeway Street) can lead to increased traffic congestion and subsequent CO problems. These areas would probably be used to varying extents during the construction period. Construction activities at staging areas more remote from the corridor (such as those in the northern industrial portion of South Boston) can lead to nuisance dust problems and particulate standard violation at these locations. With the Two-Lane Tunnel Concept, these potential problems would also be anticipated in the Bird Island Flats, the Southwest Terminal, and the Southwest Service areas of the Airport and the residences on the east side of the Jeffries Point community.

Final truck routes for all construction-related activities have not been defined as yet, but as plans for a haul road under the existing viaduct would be included in the project, it would appear that areas such as the Financial District, the Waterfront, the North End, the West End, the Fort Point Channel, South Bay, and parts of Charlestown and South Boston may be affected by truck exhaust and dust emissions. With the Two-Lane Tunnel Concept, truck emissions could also affect portions of East Boston (e.g., along Route 1A) and some of the businesses within the Airport itself.

Construction at Logan Airport

At Logan Airport, the construction of the tunnel and connecting ramps with the Two-Lane Tunnel Concept is broadly divided into three phases, progressing from the Bird Island Flats area through the Southwest Terminal area to the Southwest Service area.

During the first phase, construction activity would generally be limited to the southwest corner of Bird Island Flats, although the entire BIF Access Road would be used for access and egress to the staging area at Bird Island Flats. Under certain meteorological conditions (e.g., high wind and applicable wind directions), some adverse impact associated with high dust loading could be anticipated at the eastern part of the Jeffries Point community, and the Southwest Terminal area. The air cargo facilities and other proposed developments at Bird Island Flats could also be affected by dust emissions. Aircraft operations at the Southwest Terminal should not be affected by these dust emissions. However, aircraft operators should be made aware of the potential high dust loading in the air during high wind conditions.

The second phase of the construction would extend the tunnel from Bird Island Flats through the Southwest Terminal area to a point just past the Eastern Air Lines Reservation Center. Impact from dust emissions at Jeffries Point would continue to be felt, and might actually intensify because the construction activity would be closer to this community and at the same time the staging area at Bird Island Flats would continue to be in use. The frequency of impact from dust emissions at the Southwest Terminal would likely increase. During Phase 2, the Eastern Airlines shuttle operation and the commuter air lines operation at the Southwest Terminal would probably switch positions. This temporary switch could result in a small net reduction of aircraft emissions. However, in terms of

ambient concentrations of the various pollutants at such sensitive receptors as Porzio Park and other areas in the Jeffries Point community, this small decrease in emissions would probably not manifest itself in a significant reduction in total pollutant concentrations at these receptor locations. The air cargo and other development facilities at Bird Island Flats would continue to be affected by dust emissions.

The third phase of the construction would extend the tunnel from north of the Eastern Air Lines Reservation Center to the Airport access road. During this final phase, a number of existing buildings in the Southwest Service area would be removed. Another staging area would be established and the BIF Access Road would be relocated a little closer to the Jeffries Point community. The impact of dust emissions on Jeffries Point would continue to be a problem and the affected area might extend further west into the community. Additionally, most of the facilities in the Southwest Service Area (e.g., Sky Chefs, and rental car facilities) and the Hilton Hotel could be affected by dust emissions. During Phase 3, the Eastern shuttle and the commuter operations would switch back to their original position in the Southwest Terminal. Impact from these aircraft operations would return to baseline conditions. Impact of dust emissions at the Southwest Terminal and at Bird Island Flats would continue to be felt during Phase 3.

Truck movements and other construction-related traffic could potentially interfere with the other normal Airport traffic. If this interference were to result in loss of capacity either on the Airport access or egress roads or the Cross Road, traffic congestion would result, leading to potentially excessive CO concentrations at a number of receptor locations at the Airport (such as the Hilton Hotel and the East Boston Memorial Stadium).

Mitigating Measures

For the most part, the potential for excessively high eight-hour CO concentrations during the construction period could be alleviated by traffic control measures that would lead to reducing the increased congestion at street intersections and other local roads, or at areas that were estimated to have potentially high CO levels even before construction. In the Central Artery corridor, however, the potential traffic congestion could be so severe that normal traffic control measures alone may not be adequate to mitigate the potentially severe CO problem. During the construction period, therefore, some other alternative by-pass routes, traffic routing schemes, or disincentive measures would have to be developed to substantially reduce the traffic demand for the overly congested corridor.

A haul road for construction trucks along the Central Artery corridor would reduce the effect of this traffic on local roads and could help to control the potential dust and related impacts. The six-lane surfaced roadway under the Artery would also help maintain traffic flow through this area.

Potential CO problems at the Airport could also be alleviated by maintaining full capacity on the Airport access and egress roads and the Cross Road, through alternative by-pass routes and/or other traffic management measures.

Dust and accompanying high suspended particulates concentration is a very common and serious problem associated with construction activities, particularly in urban areas. Wetting the exposed earth areas or where practicable, chemically stabilizing these areas, and covering dust-producing materials during transport could be implemented to minimize dust emissions. Control

dust emissions at the Airport during all three phases of construction would also be required by the construction specifications.

Exhaust odor impact from trucks could most effectively be controlled by judicious designation of truck routes to avoid public amenities (public parks, restaurants), and sensitive receptor locations (residential neighborhoods). Construction haul routes would be developed during the design phase of the project with input from the public and appropriate agencies to minimize encroachment of construction vehicles into the adjacent neighborhoods.

3.7 NOISE AND VIBRATION

3.7.1 Noise

No-Build Alternative

Future Noise

Estimates of noise for the No-Build Alternative are included here for comparison with existing noise levels and with estimates of both project and non-project noise for the Two-Lane Tunnel Concept.

Future traffic noise was predicted at each of 18 noise-sensitive receptors (sites 1-4, 8-13 and 15-22A) in the project area (see Figure 32 for identification of these sites; Table 33 identifies the types of land uses and approximate numbers of people represented by these receptors). Receptors include all existing activities, developed lands, and undeveloped lands for which development is planned, designed, and programmed which may be affected by noise from the project. Site 22A (Harbor Tower Condominiums) has replaced site 22 (Harbor Towers Parking Garage) for purposes of noise prediction and impact assessment because it is a noise sensitive land use. The measured noise level at site 22 (71 dBA L_{eq}) was adjusted (to 69 dBA L_{eq}) at site 22A to reflect the increased distance from the Central Artery (the dominant noise source). The four sites not included in the present analysis (5, 6, 7 and 14) are outside the study area for the Two-Lane Tunnel Concept. Noise predictions were performed in accordance with current FHWA procedures.

Table 34 summarizes predicted design year (2010) noise levels at each selected site for the No-Build Alternative and the Two-Lane Tunnel Concept. Shown are the traffic noise contributions due to project roads (i.e., roadways constructed as part of the project), non-project roads, and the total for each site. Also included are the existing measured noise levels, the FHWA Activity Category for each site, and the site's corresponding Noise Abatement Criterion.

Of the 17 sites where existing noise levels have been determined (noise measurements were not made at site 15), two will experience decreases ranging from 2 to 8 decibels (sites 3 and 13), one site will not change (site 12), and the remaining 14 sites will experience increases ranging from 4 to 11 decibels with the No-Build Alternative. Changes in noise levels are perceptible at approximately a 4-decibel change. Applying this criterion to changes in noise levels for the No-Build Alternative between the present year and year 2010, perceptible increases will occur at 14 sites (1, 2, 4, 8-11, and 16-22A) while a perceptible decrease will occur at only one site (site 13 - Porzio Park).

Construction Impacts

For the No-Build Alternative, major sources of construction noise will include concrete saws, cranes, trucks and support equipment required for redecking operations. It is anticipated that construction will proceed using two 10-hour shifts per day over a period of three years. Temporary construction-noise effects were assessed by comparing construction noise predictions at sensitive receptor locations with existing noise levels (see Appendix 2 in this report). The results of this procedure are summarized below for this alternative.

A review of the planned construction indicates that, compared to existing noise levels, minor impact (5-10 decibel increase) from construction noise is expected at Charles River Dam Park, the Casa Maria Housing (North End), Waterfront Park and Harbor Towers. Moderate impact (10-15 decibel increase) is expected at Quincy Market, and substantial impact (greater than 15 decibel increase) is expected at the Stillman Place residences (North End).

Table 33

RECEPTORS THAT MAY BE AFFECTED BY NOISE FROM THE HIGHWAY

	Site	Activity or Land Use Represented	Approximate No. of People Represented
1.	Rotch Playground	Rotch Playground, closest to Albany Street	-
2.	St. Peter and Paul Church	St. Peter and Paul Church	-
3.	Dockside Condominiums	Dockside Condominiums, Children's Museum and associated open space	80
4.	Boston Tea Party Museum	Boston Tea Party Museum	
8.	Bremen Street residence, 1-1/2 blocks northeast of Porter St.	All Bremen Street residences directly opposite the Airport Access Road	200
9.	Bremen Street residence, 2-1/2 blocks northeast of Porter St.	All Bremen Street residences out of direct line with the Airport Access Road	140
10.	East Boston Memorial Stadium, northwest baseball backstop	Northwest portions of the East Boston Memorial Stadium	-
11.	East Boston Memorial Stadium, southeast baseball backstop	Southeast portions of the East Boston Memorial Stadium	-
12.	Maverick Street residence	All Maverick Street residences between Jeffries and Lamson Sts.	120
13.	Porzio Park	Porzio Park	-
15.	Waterfront Park, Boston	Waterfront Park, near Atlantic Ave.	-
16.	Waterfront Park, Boston	Major portion of Waterfront Park	-
17.	Edward Everett House, City Square, Charlestown	Residences near City Square with a direct view of project roads	200
18.	Charles River Dam Park	Charles River Dam Park	-
19.	Stillman Place Residence, North End	Lower floors of residences along Stillman Place, Cooper Street, and Washington Street south of Thatcher Street, with facades toward the Central Artery	480

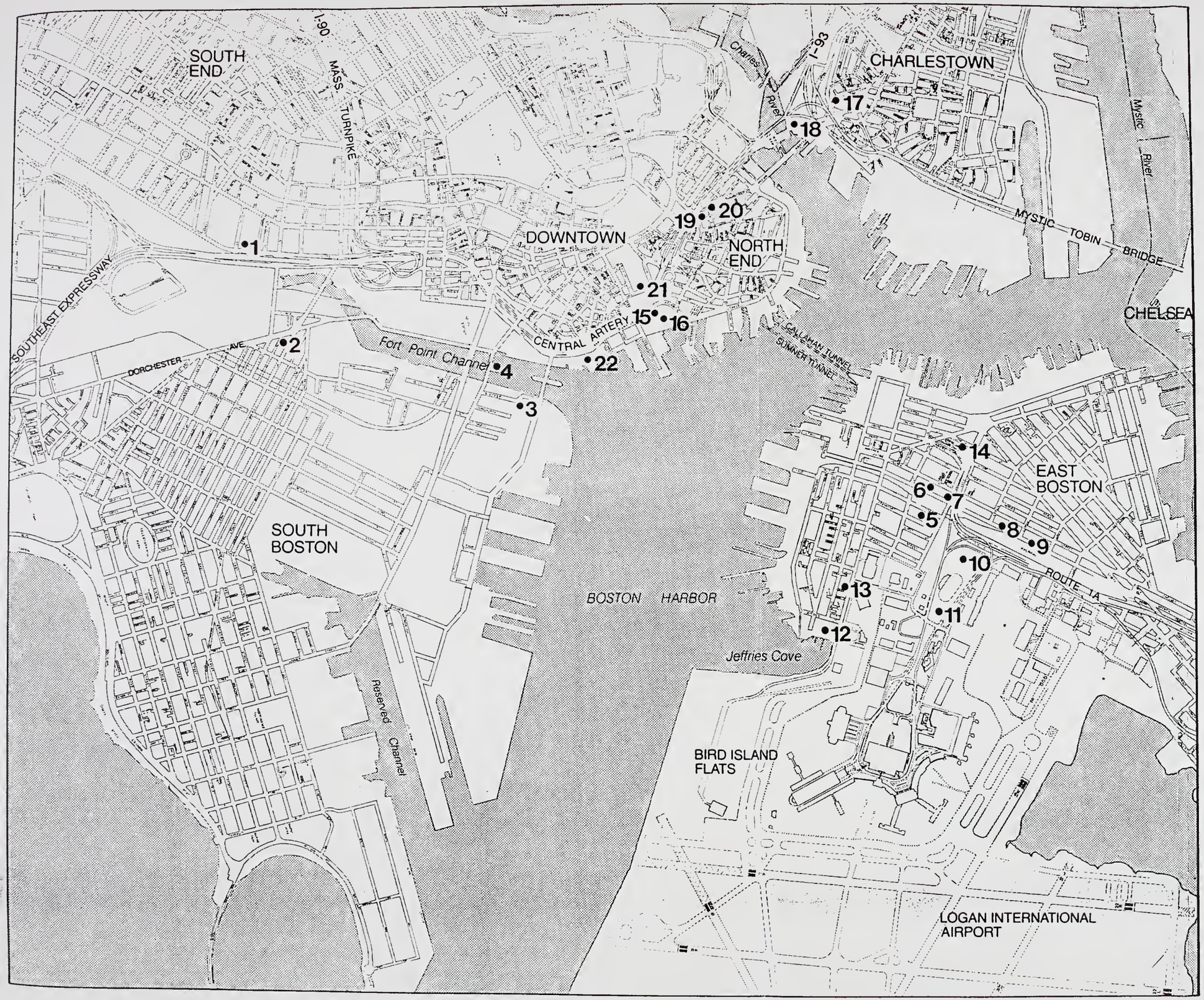


Figure 32
Existing Noise Measurement Locations

0 450 900 1800 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Table 33 (Cont'd.)

Site	Activity or Land Use Represented	Approximate No. of People Represented
20. Casa Maria Housing, North End	Upper floors of nearby multi-story dwellings within 1 block of and with facades toward the Central Artery but with some shielding by other nearby buildings	340
21. Quincy Market Mall, Commercial Street at North Market Street	East end of Quincy Market Mall	-
22A. Harbor Tower Condominiums, Boston	Harbor Tower closest to the Central Artery; condominums with a view of the Central Artery	310

Two-Lane Tunnel Concept

Future Noise

Potential long-term noise effects due to the project would be related primarily to roadway traffic. Noise impact due to the tunnel ventilation buildings would be avoided by incorporation of adequate noise abatement during facility design, as required to conform with the Boston City Noise Ordinance, and with the guidelines of the Commonwealth of Massachusetts Department of Environmental Quality Enginnering (DEQE) concerning mechanical ventilation equipment.

From Table 34, comparison of the Two-Lane Tunnel Concept and the No-Build Alternative shows that the Two-Lane Tunnel Concept would not be perceptibly louder at any of the sites. On the other hand, the Two-Lane Tunnel Concept would be perceptibly quieter than the No-Build Alternative at six sites (sites 15, 16, 19, 20, 21, and 22A), by as much as 9 decibels, primarily due to the elimination of traffic on the elevated Central Artery as a noise source.

As indicated in Table 34, there are no locations for the Two-Lane Tunnel Concept with predicted noise-level increases of 15 decibels or greater, when compared to existing noise levels. However, predicted total noise levels exceed the FHWA Noise Abatement Criterion at 16 out of 18 sensitive receptors, representing a population of about 1,870 residents.

No Category-A sites were identified. Category-B sites include all park, playground and noise-sensitive institutional sites, plus all residences with yard or balcony areas exposed directly to project noise (sites 1, 3, 4, 10, 11, 13, 15-18, and 21). Category-E sites include the Church and those residential sites without exterior activities (sites 2, 8, 9, 12, 19, 20, and 22A). Impact assessment at the St. Peter and Paul Church (site 2) assumed closed windows that provide an outdoor-to-indoor noise reduction of 25 decibels. Interior impact at the Category-E residences (sites 8, 9, 12, 19, 20, and 22A) assumed open windows that provide an outdoor-to-indoor noise reduction of 10 decibels.

Mitigating Measures

A number of noise-abatement measures could be considered for this project, including traffic management measures; alterations of alignment; acquisition of buffer zones; noise insulation of public-use or non-profit institutional structures; and noise barriers. Each of these measures has been examined for this project as described below.

Traffic-management. Traffic-management measures are sometimes feasible for noise abatement. Prohibition of truck traffic -- especially heavy-truck traffic -- would produce significant noise benefits. In the long-term, however, such prohibition is not possible for the Third Harbor Tunnel nor for the Central Artery, both of which are intended to serve as major routes for delivery of goods. Time-use restrictions on truck traffic would be similarly impossible. During construction, however, heavy construction trucks and other construction vehicles could be confined to haul roads and restricted from using local streets to the extent possible.

Lower speed limits would not significantly affect traffic noise from the project because traffic is expected to flow below posted speed limits during peak travel periods due to capacity constraints. To produce further speed reduction would require very low speed limits, and would be essentially impossible to enforce.

Alteration of Alignment. For a proposed new roadway, it is sometimes possible to alter the horizontal alignment to move it further from noise-sensitive receptors. The alignment of the Two-Lane Tunnel Concept has been developed with this

Table 34

TRAFFIC NOISE SUMMARY COMPARISON OF ALTERNATIVES, WITHOUT NOISE BARRIERS, YEAR 2010

Site No.*	Description	Daytime Hourly L_{eq} (dBA)** Existing	No-Build Alternative P	N	TOT	Two-Lane Tunnel Option P	N	TOT	FHWA Activity Category	FHWA Noise Abatement Criterion (dBA L_{eq})
1	Rotch Playground	69	-	80	80	81	<65	81	B†	67
2	St. Peter and Paul Church***	38	-	47	47	43	38	44	E††	52
3	Dockside Condominiums	73	-	71	71	64	67	69	B	67
4	Boston Tea Party Museum	65	-	75	75	66	74	75	B	67
8	Bremen St. Residence***	59	-	65	65	41	63	63	E	52
9	Bremen St. Residence***	58	-	65	65	40	62	62	E	52
10	East Boston Rec. Area	65	-	69	69	54	68	68	B	67
11	East Boston Rec. Area	67	-	72	72	61	72	72	B	67
12	Maverick St. Residence***	54	-	54	54	45	53	54	E	52
13	Porzio Park	69	-	61	61	54	61	62	B	67
15	Waterfront Park, Edge	-	-	81	81	74	60	74	B	67
16	Waterfront Park, 90 ft from Edge	69	-	78	78	71	59	71	B	67
17	Edward Everett House	69	-	78	78	76	68	77	B	67
18	Charles River Dam Park	69	-	79	79	77	65	77	B	67
19	Stillman Place Residence***	62	-	70	70	64	<55	64	E	52
20	Casa Marie Housing***	61	-	70	70	61	<50	61	E	52
21	Quincy Market Mall	71	-	81	81	71	65	72	B	67
22A	Harbor Tower Condominiums***	59	-	69	69	65	<55	65	E	52

*See Fig. 32.

** P = Project contribution; N = Non-project contribution; TOT = Total.

***Estimated interior noise levels.

†Category B refers to sites with exterior land use, including picnic areas, recreation areas, playgrounds, active sports areas, parks residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.

††Category E refers to sites with interior use only, including residences, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

intent, and has produced substantial noise benefits to East Boston. Further changes in horizontal alignment must at least triple the distance between receptor and roadway in order to produce additional significant benefits; such shifts in alignment are not feasible.

The project's vertical alignment is primarily dictated by the need to connect to existing roadways. Any small changes that remain possible would have no significant effect on noise.

Acquisition of buffer zones. Where unimproved property exists between noise-sensitive receptors and a roadway corridor, acquisition of this property can preempt future development close to the roadway. However, no such opportunities exist along the proposed project alignment.

Noise insulation of public-use or non-profit institutional structures. Noise insulation of public-use or non-profit institutional structures can be incorporated into this project.

Noise Insulation for Private Buildings. The Commonwealth is committed to developing a program to help private building owners soundproof structures immediately adjacent to construction areas, possibly through use of double pane windows and air conditioning.

Noise barriers. Noise barriers have been examined and evaluated where the total projected noise approaches or exceeds the relevant FHWA Noise Abatement Criterion. In total, noise barriers have been examined for all sites except 2 and 13 where no impact occurs.

Significant noise reduction of five decibels or more is not acoustically feasible at sites where non-project noise dominates over project noise. At such sites, even a complete elimination of project noise, through noise-barrier design, would reduce total noise by a maximum of three decibels. Unless non-project noise is five decibels or more below the total noise level, noise abatement is considered acoustically not feasible, since significant total noise reduction is unattainable. For the Two-Lane Tunnel Concept, noise abatement is not acoustically feasible at sites 3, 4, and 8-12. For the remaining sites, where noise barriers are acoustically feasible, Table 35 contains the predicted noise levels, both with and without noise barriers.

At site 1, where the proposed project would increase noise by one decibel compared to the No-Build Alternative, mitigation of 5 decibels could be achieved with a 13-foot high barrier along the edge of the mainline structure, for a length of approximately 900 feet, plus an 11-foot high ramp barrier 1,100 feet long. The total-noise benefit would be just 5 decibels due to traffic noise from surface streets. Because of the massiveness and limited benefit of these barriers, and the limited usage of this playground, it is unlikely that these barriers would be built.

At site 15, where the project would result in a perceptible decrease in noise relative to the No-Build Alternative, mitigation of approximately 9 decibels could be achieved with a 10- to 12-foot high barrier, approximately 600 feet in length, located along the western edge of Waterfront Park. Such a barrier would cost about $78,000, and would also provide approximately 6 decibels of mitigation at site 16, further into the park. Less mitigation would be achieved here because the barrier would not be as close to the receptor and because more sound energy arrives around the barrier ends. A barrier along this park edge would obstruct access to Waterfront Park. For this reason, this barrier is not likely be built.

At sites 17 and 18, where the project would result in a slight decrease in noise relative to the No-Build Alternative, mitigation of approximately 7 decibels could be

Table 35

BENEFIT FROM NOISE BARRIERS, FOR SITES WHERE NOISE BARRIERS ARE ACOUSTICALLY FEASIBLE

Site No.	Description*	Daytime Hourly L_{eq} (dBA) Existing	Design-Year (2010) No Barrier	Design-Year (2010) With Barrier	Resulting Mitigation (dB)	FHWA Activity Category††	FHWA Noise Abatement Criterion L_{eq} (dBA)
1	Rotch Playground	69	81	76	5	B	67
15	Waterfront Park, Boston: within 50 ft of road	–	74	65	9	B	67
16	Waterfront Park, Boston: between 50 and 200 ft from road	69	71	65	6	B	67
17	Edward Everett House	69	77	70	7	B	67
18	Charles River Dam Park	69	77	70	7	B	67
19	Stillman Place Residence: Lower Floor†	62	64	53	11	E	52
21	Quincy Market Mall	71	72	62	10	B	67
22	Harbor Tower Condominiums: Lower Floor†	59	65	56	9	E	52

*See Fig. 32.
†Estimated interior noise levels.
††For explanation of letter codes, see footnotes to Table 34.

achieved with 10- to 15-foot high barriers on all elevated roadways and ramps north of Causeway Street, as well as adjacent to some surface streets. These barriers would reduce project noise by approximately 10 decibels, although the total noise benefit would be just 7 decibels, due to noise from non-project roadways. Such barriers would not be likely to be built.

For the lower floor of site 19, where the project would decrease noise relative to the No-Build Alternative, mitigation of approximately 11 decibels could be achieved with a 15-foot high, 300-foot long barrier along the southern and western edges of relocated Stillman Place. This residence is typical of a large number of residences and other noise-sensitive land uses along this edge of the Central Artery. Although all residences along the corridor in this area would significantly benefit from a similar barrier, such a barrier would cut off access of the receptors to their local street. For this reason, such an extended barrier would not be likely to be built. Since it is effective in reducing noise levels as well as providing protection through isolation to this area of the North End, the more limited barrier intended to protect only site 19 would likely be built, subject to community input. This barrier would cost approximately $57,000, and would benefit about 30 people. A 10 decibel noise reduction could be achieved in the vicinity of the MDC's roadway access to the new Charles River Dam, with a 500-foot long 15-foot high barrier along the easterly edge of the Causeway Street on-ramp. It is estimated that such a barrier would cost about $171,000. Because of the potential for enhancing this area, which may be used as passive recreation space by the MDC in the future, this barrier would probably be built.

At site 21, a reduction of approximately 10 decibels could be achieved with a 10- to 15-foot high, 300-foot long barrier along the western edge of Commercial Street, adjacent to the Mall. This barrier would cost about $45,000 and would be acoustically effective because it shields not only project noise, but noise from Commercial Street as well. However, a barrier in this location would separate Quincy Market from Commercial Street and would obstruct the view of the harbor. Its intrusion upon Quincy Market would be severe and thus it is not likely to be built. Fortunately, the Marketplace Center project now under construction will tend to shield the Quincy Market area from noise generated by traffic along the Surface Artery.

At site 22, a reduction of approximately 9 decibels could be achieved with a 20- to 25-foot high, 300- to 400-foot long barrier along the Surface Artery, wrapping around the Harbor Tower Condominiums at both ends. Such mitigation would accrue only to the lowest residential floor, however. Such a barrier is impractically high and is therefore not likely to be built.

Construction Impacts

For the Two-Lane Tunnel Concept, major sources of construction noise would include pile drivers, jackhammers, trucks, cranes, excavating equipment and miscellaneous support equipment. It is anticipated that construction would proceed using two 10-hour shifts per day over a 12-year period (approximately) in downtown Boston and over a 4-year period (approximately) in East Boston, Charlestown, Fort Point Channel, South Bay, and South Boston areas.

A review of the planned construction indicates that, compared to existing noise levels, minor impact from construction noise would be expected at the Edward Everett House (Charlestown), Charles River Dam Park, Casa Maria Housing (North End), St. Peter and Paul Church, and at the Albany Street Apartments in the South End. Moderate impact would be expected at Quincy Market, Waterfront Park, Harbor Tower, and Rotch

Playground. Substantial impact would be expected at the Spaulding Rehabilitation Hospital, Stillman Place Residences (North End), the proposed Arts Building in South Boston, and at the Boston Tea Party Museum.

Mitigating Measures

Potential mitigation techniques for construction noise include limiting noisy construction activity to daytime hours near noise sensitive areas, to the extent possible; ensuring that all diesel powered equipment has effective mufflers; and erecting temporary noise barriers between noisy construction operations and nearby sensitive receptor locations. The feasibility and effectiveness of these mitigation measures depends upon the specific construction equipment and scenarios planned for the project. Therefore, a project-specific plan to mitigate construction noise would be developed during the design phase, when project-specific construction noise computations can be made. Mitigation would be incorporated as required to conform with the City of Boston Noise Ordinance. In addition, the Commonwealth would explore the feasibility of undertaking a program to soundproof affected private homes in the North End, modeled generally after the programs now being undertaken in East Boston by Massport.

Other noise control options could also be considered. For example, for impact pile driving, the use of shrouds and exhaust mufflers, or use of alternative methods (e.g., caisson drilling, vibratory pile driving or slurry wall construction) could be included.

In addition to noise from construction equipment, the potential noise effects associated with the relocation of aircraft operations at Logan Airport in the vicinity of Eastern Airlines during the early phases of tunnel construction at Bird Island Flats (BIF) were examined. Potential noise impacts on the Jeffries Point community of East Boston were assessed qualitatively, based on a review of environmental impact studies for the proposed BIF development and a proposed Eastern Airlines commuter pier.

During the initial phase of project construction at BIF, the commuter airline gate positions would be relocated slightly to the southeast, while a temporary shuttle satellite is being constructed. No change in aircraft noise levels at Jeffries Point would be anticipated as a result of this minor relocation.

Following that construction, the commuter airlines would be relocated to the present Eastern Airlines shuttle satellite, and the shuttle aircraft would be relocated to the completed temporary facility near the former commuter satellite. Primarily as a result of altered shielding effects, the relocation might be expected to result in a very slight reduction in daytime aircraft noise at Jeffries Point. In the context of total aircraft ground operation noise, however, there would be essentially no change in the equivalent noise levels at Jeffries Point.

3.7.2 Vibration

General

Potential effects of project-related vibration include damage to structures, annoyance to people and disruption of sensitive equipment operation. The severity of these effects are assessed by comparing predicted long-term and construction period vibrations at sensitive receptor locations with existing vibrations and with project vibration criteria. The basic vibration descriptor used for this analysis is the peak vibration velocity, expressed in inches per second (in./sec.); (see Sec. 3.6.2 of the FEIS/FEIR and Appendix 2 of this report). The results of this assessment are summarized below for the No-Build Alternative and the

Two-Lane Tunnel Concept.

No-Build Alternative

Long-Term Effects

Future vibration impacts for the No-Build Alternative may improve over existing conditions because of deck replacement and roadway surface restoration. However, because of the expansion joints and continued heavy usage of the viaduct, long-term future vibration impacts are expected to be similar to existing impacts, including continued annoyance at sensitive locations close to the existing Central Artery viaduct.

Construction Impacts

Construction period vibration impacts during Central Artery deck replacement for the No-Build Alternative are not expected to be significant compared to existing vibrations because of the type of construction equipment expected to be used (i.e., pavement saws, cranes, trucks, etc., rather than impact devices, pile drivers, and similar equipment).

Two-Lane Tunnel Concept

Long-Term Effects

No adverse long-term (i.e., traffic) vibration effects would be anticipated from the Two-Lane Tunnel Concept and, therefore, no long-term mitigating measures would be required. In fact, some long-term vibration benefits could be expected after the Central Artery viaduct is dismantled. In particular, at locations near existing Central Artery columns where traffic vibrations are now perceptible, vibrations would be expected to become imperceptible after the Central Artery viaduct is removed.

Construction Impacts

During construction, it is anticipated that some underwater blasting of rock would be required in Boston Harbor. Vibration generated by such blasting could affect nearby land uses, but the potential for impacts would be limited to industrial and commercial areas near the shoreline in South Boston and at Bird Island Flats. Of particular concern in these areas are the effects of blasting on the drydock and sensitive Navy vessel equipment at the General Ship facility in South Boston, and on electronic equipment at the Massachusetts Technology Center at Bird Island Flats. These potential effects would be carefully evaluated during project design when detailed requirements for blasting are developed, and appropriate mitigation measures would be incorporated as required to avoid impacts. Mitigation measures could include the use of controlled blasting techniques such as the pre-splitting or line drilling of rock, use of reduced charge weights, and limiting the depth of rock removed per blast. Assessment and mitigation of potential vibration effects for other project construction activities are discussed below.

For the Two-Lane Tunnel Concept, the major sources of vibration would be pile driving and slurry wall construction, with pile driving being the dominant source. In downtown Boston, exposure to intermittent pile driving would occur over a one to two year period for the support of relocated utilities. In addition, soldier piles would be driven over a period of about one year for site preparation in each construction section, and some sheet piles would also be driven for depressed ramps and tunnel crossings. The remainder of construction in the central area would primarily involve excavation and slurry wall construction for about 1 to 1-1/2 years in each section. In the Charlestown, South Boston, and East Boston areas of the project, exposure to pile driving vibration would generally be expected to occur for periods of two to three months at nearby sensitive locations.

Maximum vibrations during construction would be expected to be

to 20 times as great as the maximum vibrations measured at Sites E through I (see Table 35). At Site J (Spaulding Rehabilitation Hospital), maximum construction vibrations would not be expected to exceed existing maximum vibrations from commuter rail operations, but would be continuous during pile driving near this location.

There is potential for vibration-induced structural damage at the Hanover Street Post Office and Boston Police Academy in the North End during soldier pile driving within six feet of these buildings. The potential for structural damage also exists at the Purity Cheese Company building in the North End and the MBTA Orange Line subway tunnel near North Washington Street during slurry wall construction within one foot of these structures.

For tunnel construction across the MBTA Red Line tunnel in Fort Point Channel near the Gillette Company, there would be potential for vibration-induced structural damage during excavation around the subway tunnel. For construction across the MBTA Red Line tunnel in Fort Point Channel near Summer Street and across the Blue Line tunnel at State Street, vibration levels would not be expected to exceed the criterion limit for structural damage (peak velocity of 1.9 in./sec) but would exceed existing vibrations due to train operations.

In terms of minor architectural damage, analysis estimates indicate that the project vibration criteria for this effect (peak velocity of 0.08 in./sec for historic buildings and 0.20 in./sec for non-historic buildings) would be exceeded at approximately 26 residential buildings in the North End, 26 office or commercial buildings, 14 industrial buildings, and at the Boston Garden and the Children's Museum. Although a maximum ground vibration velocity of 0.35 in./sec is expected to occur at the Spaulding Rehabilitation Hospital during nearby pile driving, measurements indicate a maximum existing level of 0.47 in./sec due to nearby commuter train traffic. Therefore, architectural damage effects would not be anticipated at this building.

Temporary annoyance from construction vibration would be expected at approximately 40 three-story residential buildings in Charlestown, 52 residential buildings in the North End, Harbor Towers, the Dockside Condominiums, the Albany Street Apartments (South End), and the proposed Arts Building in South Boston (259 A Street). In addition, annoyance effects would be anticipated during construction near approximately 41 office or commercial buildings, 29 industrial buildings, 8 institutional buildings, 3 hotels, and the Spaulding Rehabilitation Hospital. The most severe annoyance to residents would be expected during pile driving in the North End, with maximum vibration velocities inside the nearest residential buildings as high as 1.0 in./sec, which could be characterized as "very unpleasant." At the Spaulding Rehabilitation Hospital and at the proposed Arts Building in South Boston, maximum building vibrations during two to three months of nearby sheet pile driving would be expected to be as high as 0.2 in./sec, which could be characterized as "unpleasant." At other affected locations, maximum construction vibrations could be characterized as "easily to strongly noticeable." Based on approximate population density, it is estimated that about 2,600 people living in the project area would be disturbed by vibration during some portion of the construction period for the Two-Lane Tunnel Concept.

The effects of construction vibration on sensitive equipment operation are of particular concern at the Gillette Company facilities in South Boston. The analysis indicates that vibration from pile driving for the supports of Gillette's temporary extended water intake pipe would exceed maximum existing building vibration at only 2 of 11 sensitive locations. This effect would occur

for a period of about one month, with a maximum peak floor vibration velocity of about 0.045 in./sec at the nearest sensitive building location. In addition, building vibrations would be expected to be noticeable at the extreme north end of Gillette's facility during pile driving for tunnel construction across Fort Point Channel. It is unlikely that these levels of vibration would affect Gillette's operations.

The U.S. Postal Service has also expressed concern regarding the effects of construction vibration on their computer equipment at the South Postal Annex. However, a comparison of predicted vibration levels with criteria recommended by computer equipment manufacturers indicates that project construction vibration would not likely affect this equipment, even though such vibration could be perceptible inside the postal facility.

Mitigating Measures

Mitigation techniques for the above vibration effects include water jetting and pre-trenching in the case of sheet piling and pre-augering and the use of low-displacement piles in the case of bearing pile driving. In addition, the substitution of slurry wall construction for sheet pile driving, where possible, could also be an effective mitigation technique. Additional means to avoid adverse effects include scheduling construction to minimize sensitive activity interference (e.g., avoiding nighttime construction near residences). The feasibility and effectiveness of such methods, however, depend on site-specific parameters, and would be evaluated during project design. Additional details regarding the assessment and mitigation of construction vibration are contained in Appendix 2 in this report. Specific measures to avoid structural damage are addressed in the Supportive Engineering Report for the FEIS/FEIR.

3.8 WATER RESOURCES; WETLANDS; FLOODPLAINS; VEGETATION AND WILDLIFE; DREDGED AND EXCAVATED MATERIAL DISPOSAL;

Construction of a two-lane tunnel under the Harbor would reduce the necessary dredging and disposal requirements of marine sediment by approximately 50 percent as compared to the four-lane tunnel with the Preferred Alternative, to approximately 470,000 cubic yards. Rock excavation, and therefore underwater blasting, would still be necessary in the vicinity of BMIP in South Boston. Other requirements for disposal of upland excavate and marine sediments from the Fort Point Channel would still be present, and the two-lane tunnel would not appreciably alter requirements for spoil disposal as discussed in Section 4.13 of the FEIS/FEIR. Because of the reduced dredging requirement, however, the time during which suspended solids are generated and marine biota are exposed to these conditions would also be reduced by approximately one-half, to approximately 50 working days.

In summary, the Two-Lane Tunnel Concept would reduce the amount of dredging and disposal requirements from the cross-harbor tunnel, but would not significantly alter the impacts to water resources, wetlands, floodplains, vegetation and wildlife, and dredged and excavated material disposal caused by the Preferred Alternative.

3.9 HISTORICAL AND ARCHAEOLOGICAL IMPACTS

3.9.1 Impacts on Historic Resources

Impacts of the Two-Lane Tunnel Concept on the historic resources identified in Section 3.11 of the FEIS/FEIR are evaluated below. Criteria of effect for historic properties have been established by the Advisory Council on Historic Preservation, which has responsibility for review under Section 106 of the National Historic Preservation Act; they include direct impacts to the property, loss of access, separation from the context which contributes to its significance, and adverse changes in the property's visual or audible environment.

Section 106 review has involved consultation between FHWA, MDPW, EOTC, the Massachusetts State Historic Preservation Officer (SHPO) and the Boston Landmarks Commission (BLC). Determinations of potential eligibility for the National Register of Historic Places for the properties discussed below were made by concurrence of the State Historic Preservation Officer (SHPO) and the FHWA. The SHPO concurred in FHWA's Finding of No Effect on several properties listed below, and a Preliminary Case Report was written to document potential adverse effects on other properties. Based on this Report, agreement was reached on the potential adverse effects and appropriate mitigating measures. A Memorandum of Agreement (MOA), detailing these mitigating measures, has been prepared, and signed by FHWA, MDPW, MHC, BLC, and the Advisory Council on Historic Preservation (see COMMENTS AND COORDINATION section of the FEIS/FEIR for copies of these).

Properties and Districts not Affected by the Two-Lane Tunnel Concept

It has been determined that the Two-Lane Tunnel Concept would have no effect on the following properties and districts identified in Section 3.11. The SHPO has concurred with FHWA's Finding of No Effect on these properties (see letter dated 7 September 1983 in COMMENTS AND COORDINATION of FEIS/FEIR):

1. Charles River Basin District
2. Bulfinch Triangle District
4. Cornhill District
5. Exchange District
7. Commercial Palace District
8. Essex-Kingston Textile District
9. Chinatown District
10. Old West Church, 131 Cambridge Street, 1806
11. First Harrison Gray Otis House, 141 Cambridge Streeet, 1796
12. Boston City Hall, One City Hall Plaza, 1961-68
15. Old State House, 208 Washington Street, 1712-13
16. Carter/Winthrop Building, 276-278 Washington Street, 1893
17. (Former) Federal Reserve Bank, 22-24 Pearl Street, 1922
18. 272-276 Franklin Street, 1877
20. United Shoe Machinery Corporation, 34-66 High Street, 1928
23. Old Waterfront District
26. Leather District
28. South Station Headhouse, 620-290 Atlantic Avenue, 1898
30. Commonwealth Pier, 1914
31. Fish Pier (1914)
32. South End National Register District (Nineteenth Century)
34. Butler Aviation Hangar (1930's), Logan Airport

Properties and Districts Adversely Affected by the Two-Lane Tunnel Concept

Downtown Boston and the North End

Owing to the large number of historic districts and properties in the downtown portion of the project area, adverse effects that apply to many properties in the downtown project area are described generally in the subsections immediately below; these effects and appropriate mitigating measures are also detailed in the Preliminary Case Report. Specific effects to individual districts or properties are then described in the following subsections.

General Long-Term Effects

The effects of depressing the Central Artery on downtown Boston's historic properties are best understood in relation to the No-Build Alternative. When it was built, the existing Central Artery cut through the oldest and most densely built area of downtown Boston, which, because of its wealth and central location, had the highest concentration of architecturally significant buildings and historic sites. In addition to the many buildings which were demolished, the combination of an elevated highway together with a multi-lane surface artery beneath it had a major adverse effect on historic properties, creating a serious blighting effect on the remaining buildings immediately adjacent to them and a significant barrier between historically contiguous areas. In recent years, the renewed vitality of some of these areas has begun to overcome these effects, but the effects are still serious. This is the situation which would be perpetuated as the long-term effect of the No-Build Alternative.

The significance of the long-term effects of the Two-Lane Tunnel Concept on the historic properties in downtown Boston would be comparable to that of the original Central Artery, but in this case many of the effects would be positive.

Visual Relationship Between Historic Properties. The greatest positive long-term effect of depressing the Central Artery would be to reestablish the visual relationship between the historic areas on either side; e.g., between the North End and the Blackstone Block. In order to maximize this positive effect, however, appropriate aesthetic mitigation and joint development measures would be implemented (see the discussion below under General Long-Term Mitigating Measures).

Access to Historic Properties. Another significant long-term effect of the Two-Lane Tunnel Concept on historic properties in downtown Boston would be improved vehicular and pedestrian access. For many of these historic properties, including both tourist-supported and commercial buildings, ease of access is directly related to economic viability, and that in turn is directly related to the ultimate preservation of the resource. Vehicular access is important, but in many cases pedestrian access is even more so, as the narrow streets and small scale of the area make Boston tourism a pedestrian exercise.

Reduced Traffic in Historic Areas. In addition to simplifying access to these areas and the individual resources within them, reduced traffic congestion with the Two-Lane Tunnel Concept would lead to decreased noise and air pollution affecting persons using or viewing these historic properties. Because current and projected traffic volumes with the No-Build Alternative are heavy on nearly all streets in the downtown project area, traffic impacts are a source of adverse effect with the No-Build Alternative.

Joint Development. There are several potential effects from the development of air rights and other joint development parcels and the creation of ventilation structures and new surface streets by the Two-Lane Tunnel Concept. Future development could help to rejoin adjacent neighborhoods with complementary building styles and land uses. However, the potential also exists for these future developments and street improvements to isolate or inappropriately alter the setting of these properties or to introduce inappropriate visual, audible and atmospheric elements such as new buildings out of scale with the historic buildings and districts or traffic on new streets. The actual effect for each property would depend on the design of street improvements and joint development parcel configurations and the application of appropriate design guidelines for massing, height, and surface treatment of ventilation buildings and subsequent joint development

buildings. Measures to minimize potential adverse effects and to maximize beneficial effects are included in the Section 106 MOA and are described below.

Except where specifically noted to the contrary in the sections below, appropriate mitigating measures can eliminate adverse effects. As stated in the Section 106 MOA, FHWA would ensure that potential adverse effects from the use of air-rights and other joint development ventures, and the development of ventilation structures and surface street improvements on historic properties described in FHWA's Preliminary Case Report, would be minimized or avoided through appropriate design. Design guidelines would be developed by the Massachusetts Department of Public Works, in consultation with the Massachusetts SHPO, BLC, and other interested groups, for joint development affecting such properties.

Preliminary and final design and construction specifications for joint development ventures, as they affect historic properties described in FHWA's Preliminary Case Report, would be reviewed and approved by the Massachusetts SHPO in consultation with BLC for consistency with the above design guidelines. The MDPW shall ensure, as a condition to disposal of joint development and air rights parcels, compliance with this stipulation prior to and following parcel disposition.

As discussed above, the potential for beneficial or adverse effects on historic properties near the project depends on the preliminary and final design of the project and related joint development. The relevant mitigating measures in the 106 MOA address these effects through review at each phase of design. Aesthetic and joint development mitigation measures relevant to historic properties would be included through this process.

Because of the proximity of many historic properties to the construction area, the extent and nature of the construction activity and the fact that so much of the historic area is on land created by the historical process of filling land in and between wharves, construction of the Two-Lane Tunnel Concept could have varying degrees of adverse effect on these properties. These effects may include noise, dust and interference with pedestrian access, and in some cases, vibration and potential foundation damage due to construction-related lowering of the water table.

Those districts which present special problems due to construction of historic structures on filled land include: the Blackstone Block District and the Causeway-North Washington Streets District.

Proximity to construction may cause potential structural vibration effects, as described in Section 3.7.2. Vibration Impacts, to the Police Station and Hanover Street Post Office in the North End District. There could be potential architectural damage in the North End District, Custom House District, Faneuil Hall Markets, and the Causeway-North Washington Streets District. There could also be effects due to noise and dust on these properties and the Richardson Block Buildings, the western portion of the Fulton-Commercial Streets District, and Russia Wharf.

General Construction-Period Mitigating Measures. As stated in the 106 Memorandum of Agreement, FHWA would ensure that potential adverse construction effects on all historic properties described in this section are minimized or avoided through appropriate preliminary and final design and construction specifications, reviewed and approved by the Massachusetts SHPO in consultation with the MDPW and BLC, and through appointment by the Massachusetts Department of Public Works of a Project Conservator whose job description and qualifications would be reviewed and approved by the

Legend

1 Charles River Basin District (NR)
2 Bulfinch Triangle District
3 Blackstone Block District (NR)
4 Cornhill District
5 Exchange District
6 Custom House District (NR)
7 Commercial Palace District
8 Essex/Kingston Textile District
9 Chinatown District
10 Old West Church (NR, NHL)
11 First Harrison Gray Otis House (NHL)
12 Boston City Hall
13 Faneuil Hall (NR)
14 Faneuil Hall Market (NR)
15 Old State House (NR, NHL)
16 Carter Winthrop Building (NR)
17 (Former) Federal Reserve Bank (BL)
18 272–276 Franklin Street
19 Richardson Block Buildings
20 United Shoe Machinery Corporation (NR)
21 Causeway – North Washington Streets District
22 North End District
23 Old Waterfront District
24 Fulton – Commercial Streets District (NR)
25 Long Wharf District (NR)
26 Leather District
27 Russia Wharf (NR)
28 South Station Headhouse (NR)
29 Fort Point Channel District
30 Commonwealth Pier (NR)
31 Fish Pier
32 South End National Register District
33 Albany Street Area
34 Butler Aviation Hangar
35 Streetcar Tunnel

NR – Listed on the National Register of Historic Places
NHL – Designated a National Historic Landmark
BL – Designated a Boston Landmark

Figure 33
Historic Resources in the Project Area

0 550 1100 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Legend
● Historic Property
Historic District

Massachusetts SHPO in consultation with the MDPW and BLC. The Project Conservator's responsibilities would include overseeing the development of measures for mitigating the adverse effects of construction on standing historic properties. These mitigation measures would be included as part of the construction specifications.

Effects on Specific Properties

Where adverse effects would result during redecking of the existing Artery with the No-Build Alternative, that fact is noted below. Otherwise, the No-Build Alternative is assumed to continue the status quo. The adverse effects and mitigating measures described below are those which would apply in addition to those described above. Numbers refer to Figure 33.

3. Blackstone Block District

Long-Term Effects. This area would benefit especially from re-establishment of the downtown's visual relationship with the North End, reduced traffic, and potentially improved pedestrian access, which would be brought about by potential improvements such as reconnecting Hanover Street and building small-scale structures above the depressed Artery.

6. Custom House District

Long-Term Effects. Removal of the viaduct would have the beneficial effect of creating an improved visual relationship between this district and the waterfront. It would also allow such important buildings within the District as the Grain Exchange and State Street Block to be viewed from street level without the adverse visual effect of the present viaduct structure. Pedestrian access between this district and its historically connected waterfront would be improved.

13. Faneuil Hall and Faneuil Hall Markets

Long-Term Effects. Removal of the viaduct would have a beneficial effect, improving the visual connection between the Markets and the waterfront (although this connection would be negated in the cases of Quincy Market and South Market, by the construction of Marketplace Center on Parcel D-10). In addition, the character of pedestrian access between the Markets and the Waterfront would be improved.

19. Richardson Block Buildings

Long-Term Effects. Removal of the Central Artery viaduct would have the beneficial effect of opening sight lines and improving pedestrian access around these buildings. The opening in the deck over the depressed Artery between Pearl and Congress Streets to provide ventilation for the Dewey Square Tunnel would have an adverse effect on the context of the buildings, but this effect would be less adverse than that of the existing Central Artery with the No-Build Alternative.

21. Causeway - North Washington Streets District

Long-Term Effects. As currently configured, the alignment of the Two-Lane Tunnel Concept involves the taking of the Charles River Building and the loading dock at the west end of the Stop and Shop Bakery Building for construction of a connecting ramp from the depressed Central Artery northbound to Storrow Drive. Because of its position in relation to the Stop and Shop Bakery Building and the Hoffman Building, and the limited number of buildings in the area, removal of the Charles River Building would further permanently alter the historic fabric and character of this area, which has already been negatively affected by construction of the original elevated Central Artery.

The Two-Lane Tunnel Concept would also have the beneficial effect of removing the Central Artery viaduct from the historic Bulfinch Triangle area and partially reuniting the

Causeway-North Washington Streets District with the Bulfinch Triangle (potentially eligible National Register District) to the west.

A ten-story ventilation building measuring approximately 60 feet by 80 feet would be built on the former site of the Charles River Building. This new building would not be altogether out of character with the industrial nature of this historic district.

Mitigating Measures. As stated in the 106 Memorandum of Agreement, FHWA would ensure that the loading facilities of the Stop and Shop Bakery Building would be modified either to continue present operations or to serve an alternate building use with lesser loading requirements, in order to ensure the continued economic viability of the building. Preliminary and final design and construction specifications for the building modifications would be reviewed and approved by the Massachusetts SHPO in consultation with the BLC.

Design guidelines for the development of the ventilation building would be developed by the MDPW, in consultation with the Massachusetts SHPO and BLC.

FHWA would ensure that prior to alteration or demolition of the Charles River Building and Stop and Shop Bakery Building loading dock, the Historic American Building Survey (HABS)/Historic American Engineering Record (HAER) would be contacted to determine the level of documentation required to provide a permanent record of the properties. All documentation must be accepted by HABS/HAER prior to alteration or demolition of the properties.

22. North End District

Long-Term Effects. The Two-Lane Tunnel Concept would have a beneficial visual effect upon the historic properties of the North End District. The District would once again be visually linked with the downtown area, although not in exactly the same manner as it was prior to the construction of the Central Artery. The original Central Artery project removed a series of small irregular streets east of the Blackstone Block District connecting it with the North End. Appropriate design of surface street connections over the depressed Artery and appropriate guidelines for joint development would result in buildings compatible in scale and materials with those in the surrounding districts, which though not recreating the original urban fabric, would approximate it.

A wide area of traffic lanes and open space, or super-block construction, would not be consistent with the historic access to the North End which was through an intricate pattern of narrow streets. The principles discussed in the aesthetic mitigation measures and joint development recommendations (Section 4.4.4 of the FEIS/FEIR) of reinstating a complex pattern of sight lines and appropriately scaled buildings across the depressed Artery would be applied in the development of design guidelines as required in the 106 Memorandum of Agreement, and would result in an improvement over the present and No-Build situations. Dispersing pedestrian access through several street connections in this way would likewise reinstate something approximating the historic approach to the North End.

Construction Effects. The North End is particularly sensitive to construction effects since it is a place to live, shop, and visit. For this reason, construction effects would negatively affect historic structures, in that economic viability is often a key factor in their preservation and maintenance. Appropriate mitigating measures would minimize these effects.

Mitigating Measures. Appropriate design guidelines regarding height, materials, and massing would be applied to the joint

development parcels on the surface right-of-way, and design of surface street connections would be reviewed to ensure that adverse effects to the historic context are avoided and minimized, and historic connections between the North End and downtown Boston are partially restored.

24. Fulton-Commercial District

Long-Term Effects. Removal of the Artery viaduct would potentially improve the visual relationship between this district and the Faneuil Hall Markets-Blackstone Block area, with which it was historically closely connected. The Two-Lane Tunnel Concept allows potential improvements such as those aesthetic mitigation measures and joint development recommendations for building over the depressed Artery and reconnecting streets which are discussed in Section 4.4.4 Joint Development of the FEIS/FEIR; these measures would be applied to the development of design guidelines for joint development and design review of surface improvements to reestablish a continuity in urban fabric which would improve the character of the pedestrian access between these two historically important areas.

25. Long Wharf

Long-Term Effects. Removal of the Central Artery viaduct would have a positive effect on restoration of the historic relationship between Long Wharf and State Street, with the Old State House, one of the most important historic sightlines in Boston, at its head. This visual relationship would be stronger, and pedestrian access would be improved.

27. Russia Wharf

Long-Term Effects. There would be no long-term effects on Russia Wharf.

29. Fort Point Channel District

Long Term Impacts. This Concept would shorten the Channel up to Mt. Washington Street. Additionally, although no deck would be placed on top of the tunnel structure in the Channel (i.e., no relocated Dorchester Avenue), thus reducing visual impacts and alterations to the bulkhead and historic Summer Street and Congress Street Bridges, this concept would make the tunnel structure itself visible at low tide from Congress Street to the south end of the waterway. This situation is not altogether inconsistent with the present character of the Channel, in which bottom shoals and submerged structures are exposed at low tide.

Of the structures which span the Channel, only one would be removed (as in the other alternatives) with the Two-Lane Tunnel Concept: the Old Colony Bridge. The bridges at Congress and Summer Street would have portions on the Boston side of the Channel dismantled and reconstructed, and would be rebuilt in a manner consistent with the structures' original profiles.

This Concept, which would involve the construction of a tunnel under South Boston, would cause two buildings (40 Wormwood Street and 293 A Street) that lie in the Boston Wharf Company section of the Fort Point Channel District to be taken. Although each has contributed historically to the development of this district, neither is architecturally significant, and neither is individually eligible for the National Register. Removal of these buildings would not affect the integrity of the district.

A 10-story ventilation building measuring approximately 80 feet by 90 feet would be constructed on the filled portion of the Channel south of Dorchester Avenue.

Construction Impacts. During construction, the Two-Lane Tunnel Concept would alter vehicular and water access to the Fort Point Channel. Access would be affected as a result of successive closings or

reductions in width of the bridges, and the use of temporary bridge structures; the placement of steel sheeting in the Channel; and the presence of barges and construction equipment.

There would be additional construction impacts in the Boston Wharf Company section of the Fort Point Channel District. Although these are industrial and commercial neighborhoods, the Two-Lane Tunnel Concept would create additional short-term noise, dust, and vibration impacts on these areas' buildings, a number of which have recently been rehabilitated.

Mitigating Measures. As stated in the 106 MOA, FHWA would ensure that design development in this area would include the following:

o Design and location of the ventilation building in a manner that is sympathetic to, and respectful of, the characteristics of surrounding historic properties with regard to massing, color, building material, detail, and scale.

o Granite facing would be used in the new section of the Fort Point Channel bulkhead to make it visually consistent with the existing bulkhead in color, texture, configuration, and design.

o Reconstruction of the one span of the Summer Street Bridge removed during project construction would be in a manner that reuses as much original fabric as possible and results in the same configuration as the original.

o Preliminary and final design, and construction specifications, would be submitted to the Massachusetts SHPO prior to start of construction for review and approval in consultation with the BLC regarding consistency with the design development guidelines outlined above.

33. Albany Street Area

Long-Term Effects. There would be no significant effect on this historic area.

35. Streetcar Tunnel

Long-Term Effects. There would be no significant effect on this historic structure.

Construction Effects. Vibration could cause potential structural damage.

Mitigating Measures. Construction period mitigating measures include tunnel reinforcement, placement of piles on either side of the tunnel, and spanning over the tunnel with the Central Artery structures. A granular cushion material would be placed between the Blue Line and Central Artery tunnels. (See the Supportive Engineering Report for a more detailed discussion of these techniques.)

3.9.2 Archaeological Effects

A Phase I, Step 1 archaeological survey was undertaken for this project. The reconnaissance level survey focussed on the South Bay, South Cove, Fort Point Channel and Fort Hill areas of Boston; and the Conrail railroad right-of-way and parts of Logan Airport in East Boston. The survey indicated a high probability of significant historic archaeological resources in all of these areas, including evidence of remains of rope walks, remains of maritime trade and wharves, and refuse from industrial and institutional development. It also indicated that prehistoric sites are likely to be located in the South Bay/South Cove and East Boston railroad right-of-way areas, yielding relevant climatological, geological, floral, and paleontological data and providing information on past human subsistence practices and settlement patterns.

The survey also covered the Central Artery and South Boston corridors. In the Central Artery corridor, between Dewey Square and the Causeway Street area of Boston,

prehistoric and historic archaeological sites are likely to exist within the original land mass. These sites would cover several time periods and functional or cultural affiliations, since this area is one of the most significant archaeological zones in the greater Boston area. In the South Boston corridor, prehistoric archaeological sites inundated after their occupation by rising sea levels and subsequently filled may also be found. The remains of prehistoric sites may also be preserved within the bounds of South Boston's original land surface. Historic archaeological resources of possible significance are primarily 19th and 20th century, owing to the more recent development of this area in comparison to nearby areas of South Boston and Boston. Remnants of the out wharves, buried footings from the Atlantic Avenue elevated railway, vestiges of the 18th century timber wharves and piles, and possibly stone seawalls may be encountered. Remnants of the former Mill Creek may also be encountered.

The results of the Phase I, Step 1 survey report have been reviewed by the Massachusetts Historical Commission, the State Historic Preservation Officer and the Boston Landmarks Commission.

As stated in the 106 MOA, FHWA would ensure that a Phase I, Step 2/Phase II investigation is initiated 90 days following ratification of the 106 MOA and release of funds for additional planning and design studies. This investigation would include, at a minimum, the following elements:

o Preparation of an appropriate research design, outlining and justifying important research problems that may be addressed by investigation of archaeological properties in the project area, and a proposed scope of work and work plan for field investigation integrating the results of the following work:

acquisition of additional historical documentary information on past disturbances that may preclude areas from field testing, and

acquisition of additional historical documentary information concerning potential significance of historic and prehistoric archaeological remains.

This program for investigation, including the research design, scope of work and work plan would be reviewed by MDPW and the SHPO prior to implementation.

o Field testing and evaluation would be implemented based on the scope of work and work plan and in the context of the research design.

o A written report describing the results of the documentary research, field testing and applied National Register criteria, and containing recommendations on the significance of identified resources, would be provided to MDPW, the Massachusetts SHPO, and BLC. These recommendations would be subject to review by MDPW and the Massachusetts SHPO in consultation with BLC.

o Based on the results of the documentary research and field testing work, a plan would be developed in consultation with the SHPO and BLC that would include provisions for avoidance or preservation in place of significant archaeological remains, where feasible and practical, through design and engineering development or construction specifications as set forth above. If avoidance or preservation in place is not feasible and practical, and the SHPO concurs in this determination, the plan would include provisions for Phase III data recovery or other appropriate treatment. The plan would be submitted to the Massachusetts SHPO and the Advisory Council for review and approval in consultation with BLC prior to implementation.

At such time as the nature, extent, and locations of necessary

utility line relocations are known, identification, evaluation, and treatment plan preparation and implementation would be done in the same manner as set forth above for any significant archaeological properties which may be affected by these activities.

All historic and archaeological investigations called for under these stipulations would be conducted by individuals who meet, and in a manner consistent with, the Advisory Council's standards and guidelines.

3.10 AESTHETIC IMPACTS

South Bay

Today, as drivers enter the City on the Southeast Expressway and the Massachusetts Turnpike, they pass through an area which includes tidal flats, a granite bulkhead, old piers, and a historic railroad bridge spanning Fort Point Channel. These surviving elements from the active commercial and shipping era of the Channel's history are a visual entry point to the City, and to many motorists are the first impression of Boston's character as a port city.

View from the Road

The Two-Lane Tunnel Concept would replace the open water in this area with a landscaped space covering the ramps connecting the Central Artery and Massachusetts Turnpike to the new tunnel. The ventilation building would be a visually prominent object in this area. It would be on a direct sight line for drivers entering Boston on the Southeast Expressway or Massachusetts Turnpike. Its size and location would make it a new visual landmark at the city's principal highway entrances from the south and west.

View of the Road

In the South Bay corridor, all tunnel ramps would be located below grade, and the only visually prominent facility would be the new ventilation building mentioned above. The project would result in improved visual quality by removal of the present physical and visual clutter in the area associated with remnants of pier and railroad structures and stockpiled fill.

Pedestrian Environment

Today, pedestrian circulation is difficult owing to the maze of rapid transit, railroad, and highway rights-of-way. Pedestrian orientation and access through this area would be improved by removal of these physical and visual obstructions.

Fort Point Channel

View from the Road

In the Fort Point Channel area, the Two-Lane Tunnel Concept would have no surface roadway elements. Therefore, the view from the road would be entirely within the tunnel and would be of tiled tunnel walls and other vehicles.

View of the Road

The northbound Central Artery would be built as a tunnel in the Fort Point Channel, parallel to its western bulkhead. The connection between the Third Harbor Tunnel and the Southeast Expressway and Massachusetts Turnpike would be built as a tunnel which crosses the Fort Point Channel just south of the Postal Annex. These two tunnels would result in a reduction of water area in the Channel. The Central Artery tunnel and new bulkhead line would extend approximately 110 feet into the Channel at its widest point (south of the Summer Street Bridge). As the tunnel profile continues to drop, the new bulkhead line would taper back to the existing bulkhead line. At a point midway between the Congress Street and Northern Avenue Bridges, the box would no longer be visible. The top of the box would be approximately two feet lower than the top of the existing bulkhead but the construction of this tunnel section in the Channel would introduce a new geometry which is inconsistent with the parallel lines of the existing granite bulkheads. No surface roadways would be visible in the Fort Point Channel.

The Third Harbor Tunnel in crossing the southern end of the Channel would decrease the length of Fort Point Channel by 600 feet. Due to the long, narrow geometry of the Channel, views of the water from bridges across the Channel would not be significantly affected, but from other vantage points this loss of water surface would be very apparent.

This portion of the project would include an open section 200 feet long. This section would be visible to pedestrians in the area; however, it is not an area which is frequented by many people. A ventilation building would be located on top of the depressed Central Artery, west of Atlantic Avenue. It would have no visual impacts on the Fort Point Channel.

Pedestrian Environment

The pedestrian environment in the Fort Point Channel area would not be significantly affected by the Two-Lane Tunnel Concept, as the roadway elements would be concentrated in an area south of Summer Street where there is very little pedestrian activity.

Mitigating Measures

With mitigating measures, the Two-Lane Tunnel Concept could have a positive impact on the pedestrian environment through the provision of a pedestrian walkway on top of the tunnel box between the Dorchester Avenue Bridge and Northern Avenue. The top of the box could be designed as a recreation area for water-related uses.

The new bulkhead at the end of the Channel and the relocated western bulkhead would reuse the granite from the existing bulkhead. The open section of the tunnel would be screened with louvers to minimize visual impacts on adjoining areas.

South Boston

View from the Road

Motorists driving on the roadway would alternate between enclosed tunnel sections and open depressed roadway sections. The motorist exiting or entering the tunnel at the Congress Street exit would see the Fort Point Channel 19th century warehouse district on the west, as well as new development to the north and east.

View of the Road

From Commonwealth Flats, the project's toll plaza, ramps and ventilation buildings would be visible in open cut from Summer Street to the eastern edge of Commonwealth Flats. Since this property is not yet fully developed, it is difficult to predict what the visual impact would be in the future. However, it is clear that the highway facilities and ventilation structure would be visually significant.

If current Massport plans for parking and fish distribution are put into effect, the impact would not be expected to be significant because these uses are not particularly visually sensitive.

The road would be most visible from Viaduct Street; the view from this point would include the toll plaza, Northern Avenue ramps, and ventilation buildings. The ventilation buildings located east of Viaduct Street would be placed within an industrial landscape, within which they would be the tallest elements. The ventilation building located north of Northern Avenue would be visible from the harbor and possibly from across the harbor.

The ventilation building near A Street would be a noticeable element in this area of 19th century industrial buildings.

The access road connecting the tunnel to Northern Avenue would require a right-of-way wider than the streets it parallels. The visual separation which it would create between the existing structures on Stillings Street and the parcel to the east of the access road would not allow the continuation of the area's existing street and building pattern.

The entire tunnel alignment cuts through northern South Boston on a diagonal line, which is not consistent with the grid layout of streets and buildings which has been established in the area. The careful

placement and orientation of project ramps and ventilation buildings could help to reduce the impact of this new diagonal element in a district characterized by a retilinear pattern of streets and buildings.

Pedestrian Environment

The area in which the Two Lane Tunnel Concept is located does not presently attract a great number of pedestrians. Future plans for the area concentrate pedestrian use along the waterfront side of Northern Avenue, and would not be affected by the project. The depressed roadway would not be visible from Northern Avenue. Ventilation buildings and ramps would be visible, but not significant to the overall appearance of the area.

In the Congress Street area, tunnel related signing and lighting would be noticeable elements in the pedestrian environment.

Mitigating Measures

Architectural treatment and alignment of the ventilation building in conformance with existing building placement would minimize visual impacts on neighboring parcels.

The Central Artery

While the Central Artery passes through a number of distinct districts and neighborhoods, some effects of removing the viaduct are common to all areas:

o Today, people walking under the Artery experience a dark environment where the impact of vehicle noise and exhaust is frequently intensified by the viaduct; in the future, the experience of crossing or walking parallel to the Artery Corridor would be like that of walking on a typical city street, and the pedestrian environment would be greatly improved.

o The establishment of a pattern of primarily rectilinear parcels and streets would provide a better sense of orientation for both drivers and pedestrians.

o Removal of the overhead roadway, ramps, piers, and columns would re-establish visual continuity between areas of the city which were severed by the elevated highway construction 25 years ago. Removing ramps in the Haymarket/North End area, and between the Financial and Waterfront Districts, would open up views which do not presently exist and removing the deck and pier supports from other areas would allow clear views along cross-streets which intersect the corridor and are presently obstructed by the structure.

o Relocating the ramps connecting surface streets and the Central Artery would alter surface traffic patterns and volumes. The new Surface Artery would carry the fuel and other hazardous cargo trucks which presently use the elevated Artery, thus making them more noticeable to pedestrians.

o There would be several secondary visual impacts when buildings are constructed on parcels over the tunnel. Oblique views under the elevated Artery would no longer be possible, as the new buildings would block diagonal sight lines and channel all views along the new surface street corridors. Views from existing buildings adjacent to the Artery corridor would be affected as well; the sense of openness over and around the existing Artery would change as development occurs and the Artery corridor assumes a physical character and density much like that of the adjacent districts.

o The experience of driving through or into Boston on the Central Artery would be radically altered when traffic on the existing elevated structure is placed in the new tunnel. From a strictly visual point of view, the elevated highway offers two advantages:

1) Drivers entering Boston have the opportunity to see landmarks, select an exit ramp, and drive to

their destination with a sense of its character and location in mind. Travel in a tunnel clearly precludes this sense of orientation.

2) The views from the elevated structure across the North End into the Quincy Market, out to the Harbor, and up to skyscrapers of the Financial District offer a diverse visual experience for drivers crossing the city; this experience of changing vistas has been observed and commented upon by many, and would be lost if the highway were placed in a tunnel.

The aesthetic experience of driving in a tunnel is less desirable than that of driving on an elevated or surface road. Although there are examples of tunnels designed with particular concern for creating a pleasant environment, artificial lighting and views only of the roadway, tiled surfaces and other vehicles typically offer a meager experience in contrast to the open and visually rich environment on the surface.

However, the use of tunnel offers a balancing opportunity to improve the visual experience of driving on the new Surface Artery. The new street system would offer clear uninterrupted views along its length and along crossing streets at intersections.

o Today the elevated Central Artery is a continuous element in the landscape, and when it is removed, the open corridor would appear as a long linear open space. As the corridor is developed with buildings and public spaces, the physical character of its blocks and streets would take the form of the neighborhood or district through which it passes. The potentially disruptive appearance of an oversize linear element would be replaced by an integrated urban streetscape.

o The ventilation buildings and ramps to and from the depressed Central Artery would cause aesthetic impacts on areas directly adjacent to them. Impacts of these project elements and mitigating measures are described below. For further discussion of mitigating measures, see Section 4.4.4 Joint Development of the FEIS/FEIR.

The description of aesthetic impacts in the area between the Dewey Square Tunnel and Causeway Street is presented by sub-area. The two important impacts noted below apply to each individual area.

1. View from the Road. For motorists within the tunnel, the view would be of tiled surfaces and other vehicles, as described above.

2. View of the Road. Views of the road would be greatly diminished as a result of the removal of the elevated Central Artery. The road would no longer be the dominant visual element in the area; rather, small portions of the project, such as ramps, would be visible from city streets.

Financial District: Central Artery - Congress Street to High Street

View from the Road

There would be new views of the City for motorists driving on the Surface Artery or on streets perpendicular to the Surface Artery. This would be particularly important for motorists approaching downtown via the new Northern Avenue Bridge. Under existing conditions, views of downtown are blocked by the Central Artery structure which is in a transition section between elevated roadway and tunnel. With the project, these drivers would have unimpeded views up Oliver Street into the heart of the Financial District.

View of the Road

The ramps to and from the depressed Central Artery would be open depressed sections parallel to the Surface Artery. They would resemble the ramps to and from the existing Dewey Square Tunnel.

The ventilation system for the Dewey Square Tunnel requires an open section between Pearl and Congress Streets. This would be a negative element in terms of views from surrounding buildings. The 10-story ventilation building located adjacent to the new Surface Artery near Atlantic Avenue would be the most visible project element in the area.

Pedestrian Environment

For pedestrians walking along the Surface Artery, the environment would be significantly improved in this area in terms of visual quality, air quality and noise levels.

The pedestrian environment would be enhanced by the opening of new views along Pearl, Oliver and High Streets.

Mitigating Measures

The open tunnel section between Pearl and Congress Streets could be over built by air-rights development which incorporates a ventilation system for the Dewey Square Tunnel. The on- and off-ramps designed as open sections could also be enclosed in an air rights development on the newly created parcel.

The ventilation building would be accommodated in air-rights development either through incorporation in building structures or through special architectural treatment, consistent with the Section 106 Memorandum of Agreement (MOA).

Broad Street District: Central Artery - High Street to State Street

View from the Road

For motorists driving on the new northbound Surface Artery, a new visual environment would be created. The road would curve to the left as it approaches Harbor Towers, as it does today. With the elevated Central Artery removed, however, drivers would have a dramatic view of the Grain Exchange Building and the U.S. Customs House. Design guidelines to ensure that these sight lines remain open and that the heights of new buildings do not conflict with vistas opened by the removal of the Artery could be prepared (see Section 4.4.4, Joint Development in the FEIS/FEIR).

View of the Road

The ventilation building adjacent to the northbound Surface Artery at High Street would be visible to pedestrians walking along the Surface Artery and to residents of the Harbor Towers Building.

Pedestrian Environment

The new Surface Artery would provide a pleasant experience for pedestrians walking above the depressed Central Artery, in contrast to existing conditions. Pedestrian crossings would be improved at all access points between downtown and the pedestrian esplanade along Long Wharf, the New England Aquarium, Harbor Towers and Rowes/Fosters Wharf. Milk Street would be continuous from the center of downtown to the Waterfront. High Street would cross the depressed Central Artery and connect with a 30-foot wide pedestrian access corridor established by the BRA design guidelines for the northern edge of the Rowes/Fosters Wharf parcel.

Uninterrupted views of the harbor would be created from the Broad Street District along High, Broad, India, Milk and State Streets. The Broad Street sight line, currently obstructed by retaining walls, would be re-established in a manner consistent with the BRA's design guidelines for Rowes/Fosters Wharf.

The Broad Street Historic District would be visually and physically reconnected with the Waterfront.

Mitigating Measures

The temporary ventilation buildings would be accommodated in air-rights development either through

incorporation in building structures or through special architectural treatment consistent with the Section 106 MOA.

Waterfront/Quincy Market - State Street to Clinton Street

View from the Road

Removal of the existing Central Artery structure would provide drivers on the new Surface Artery with clearer sight lines and an improved orientation to the street pattern.

View of the Road

No visible portions of the Central Artery would be constructed in this area.

Pedestrian Environment

The "Walk-to-the-Sea" would be enhanced by a pedestrian easement across the new parcel created over the depressed Central Artery. Pedestrian activated signals would insure safe and convenient access across the Surface Artery. The visual connection between the Market area and the harbor would be re-established. As buildings are developed on air rights over the depressed Central Artery, views would be channelled along streets and pedestrian corridors. State Street's historic function as an important link connecting Long Wharf to Boston's commercial center would be enhanced by the removal of the Central Artery.

North End/Haymarket - Clinton Street to Endicott Street

View from the Road

Motorists travelling on the Surface Artery would have views of Boston's most historic neighborhoods, the North End and the Blackstone Block. New development on parcels above the depressed Central Artery would provide view corridors across the depressed Central Artery. New buildings constructed on air-rights parcels would be designed to assure adequate sight lines at intersections and to re-establish the building pattern.

The new Surface Artery and ramps to the Sumner and Callahan Tunnels, with proper signing, would make these areas clearer and more understandable to the driver.

View of the Road

The ramp from the Central Artery northbound to the Surface Artery (in the vicinity of North Street) would be placed on the side of the street, away from the North End. It would be visible from the street, but should not be very obtrusive. The tunnel ramps permitting access from the north into the Sumner Tunnel and into the Central Artery southbound would be masked by new development placed around them.

Overhead signs and lighting for highway elements would be necessary in this area. Design of these elements would be carefully monitored to ensure that they are compatible with the character of adjacent areas and are as unobtrusive as possible.

Pedestrian Environment

This portion of the Central Artery corridor has a high volume of pedestrian movement between the North End, downtown and the Quincy Market area. Removal of the elevated structure would provide the large number of residents, shoppers and tourists with more pleasant routes, open to the sky. The existing Central Artery southbound off-ramps and northbound on-ramps totally block cross-corridor views under the Artery and restrict pedestrian access. With the construction of the depressed Central Artery, sight lines across the corridor would be opened at Hanover, Salem, and North Streets.

A significant improvement in the pedestrian environment would occur as a result of the reconfiguration of the Surface Artery which would provide pedestrians on the east side of Cross Street with a pedestrian walk over the

covered portals of the Sumner and Callahan Tunnels and signalized street intersections at Commercial and Fulton Streets. This area is currently a dangerous and obstructive element to pedestrian circulation in downtown Boston.

Mitigating Measures

The ventilation building that would be temporarily constructed at the intersection of North and Cross Streets could ultimately be accommodated in air-rights development either through incorporation in building structures or through special architectural treatment consistent with the Section 106 Memorandum of Agreement (MOA).

The exit ramp from the northbound Central Artery tunnel to the Surface Artery, running parallel to Cross Street, could be enclosed in a building envelope to enhance the appearance of these newly-created parcels.

Haymarket Square

View from the Road

Haymarket Square would be the focal point for drivers entering Boston from the north via North Washington Street, Interstate Route 93 and the Mystic-Tobin Bridge. The design of signing, lighting and other project elements would reflect the importance of this public space as an entry point into downtown Boston.

View of the Road

The Haymarket intersection would carry such significant volumes of traffic that a large expanse of paved area would be necessary. The many movements occurring in the area would require many directional signs which would require careful design to avoid contributing to visual clutter.

The views of this area from the North End would be buffered by development on the parcel between the Surface Artery and Stillman Street.

Pedestrian Environment

Currently, pedestrians crossing the North End to the Haymarket MBTA station have to work their way around local and regional traffic under the Central Artery. The new Surface Artery would provide some safe, direct crossings with pedestrian traffic signals.

North Station/Bulfinch Triangle - North Washington Street to Causeway Street

View from the Road

Motorists driving on the northbound Surface Artery would be adjacent to handsome 19th Century industrial buildings; motorists on the southbound Surface Artery would have views of the Blackstone Block and the area around Quincy Market. On this portion of the Surface Artery drivers would be on a roadway which forms a logical street pattern with adjacent city streets, thus enhancing the sense of orientation.

Drivers entering Boston on North Washington Street would have improved sight lines into downtown Boston.

View of the Road

When the Central Artery viaduct is removed, the physical and visual character of the North Station/ Bulfinch Triangle would be altered dramatically. Views would be opened between North Washington Street and downtown and along Traverse Street. With the reconstruction of Beverly and Traverse Streets, the physical layout of the Bulfinch Triangle would be re-established.

Pedestrian Environment

The elevated Central Artery is a major barrier to pedestrian movement in this area. With the removal of this structure, many impediments to sunlight, circulation, and activity would be eliminated. Causeway Street would become visually continuous, with

only the single bridge of the relocated Green Line crossing the roadway overhead. Controlled intersections at Haverhill and Beverly Streets would ease pedestrian movement, in contrast to the free-moving vehicle ramps that exist today. Development of new parcels along Causeway Street would increase street-level activity, further improving the pedestrian environment. The project would provide the opportunity to create a landscaped area on MBTA-owned land adjacent to the new southbound Surface Artery.

Views along North Washington Street are currently obscured due to the rising of the street and the low, oblique crossing of the elevated Artery structure. This important corridor between Charlestown and downtown would be re-established, greatly improving the present pedestrian environment. Development of parcels created along these routes would also improve the pedestrian environment.

North Station/Charles River - Causeway Street to Charles River

View from the Road

North of Causeway Street the Central Artery would emerge from a tunnel and rise onto bridges over the Charles River. For northbound motorists, this would be the first opportunity to view surrounding areas since entering the depressed Central Artery.

Views available to drivers entering Boston on southbound Interstate Route 93 are presently blocked by the overhead northbound structure. The new northbound and southbound bridges would be separated, so inbound motorists would have a dramatic vista of downtown Boston before they enter the Artery tunnel, with sightlines focused on the U.S. Customs House Tower. Northbound motorists would have views across the Charles River to Charlestown and Bunker Hill, as they emerge from the tunnel. The rising profile of the bridge would inhibit this view to some extent.

View of the Road

Just north of Causeway Street, the Central Artery would emerge from the tunnel onto a ramp on retained fill, rising to meet the new bridge across the Charles River. This roadway section would be visible from Causeway Street, the Hoffman Building to the east, the vacant parcels to the west, and the banks of the Charles River. Two open ramps connecting the Central Artery and Storrow Drive would be visible from the proposed MDC walkway along the Charles River; one of these is near the Interstate Route 93 southbound bridge, the other near Leverett Circle. An additional ramp would allow traffic traveling from the south on the Central Artery to connect to the surface at Leverett Circle with movements to Cambridge. This ramp would require the relocation of the bulkhead and also would interrupt the proposed MDC walkway (for a more complete discussion of these impacts see Section 3.11 Section 4(f) Evaluation.

As presently designed, the bridges across the Charles River would require six steel trusses approximately 60 feet in height. Their location would make them an important visual element in the Charles River area, and they would have negative visual impacts on the proposed MDC linear park and buildings in the area. A ventilation building would be located next to the MDC dam access road, and would also be a prominent visual element.

The overall impact of the project in this area would be significant. Roadway elements would be closer to the ground and would affect views across and along the banks of the Charles River.

Pedestrian Environment

The roadway and sidewalk between Causeway Street and the Charles River Dam would no longer pass

under an elevated structure; rather, it would parallel an open roadway section which would be rising to meet the bridges across the Charles River. The bottom of the roadway would be only 15 feet above the edge of the Charles River, and would create a darker and less attractive river bank than currently exists. Noise and air quality would be somewhat worse than they are at present. The relocated MDC access road connecting Causeway Street and the Charles River Dam would be designed as an attractive landscaped pedestrian way connecting the North Station area and downtown to Charlestown via the Charles River Dam. A noise barrier which would also serve as a visual buffer between the Central Artery ramps and the walkway would decrease the impacts of the project on this walkway.

The ramps connecting the Central Artery and Storrow Drive near Leverett Circle would affect the plans for a continuous walk along the Charles River between the new and old Charles River Dams. The ramps would preclude the connection of a riverbank walkway to the adjacent land areas for a distance of approximately 775 feet.

Views from Causeway Street to and across the Charles River would be improved. A sight line to City Square and the Bunker Hill Monument would be created.

Mitigating Measures

The bridges across the Charles River would be designed as attractive structures which add visual interest to the area; for example, they could be suspension or static cable bridges. Minimizing the bulk of structural members would reduce impacts on views across the Charles River and make the structures appear lighter.

The placement and design of the ventilation building would be adjusted to minimize its impacts on views, and architectural treatment would allow the ventilation building to become a complementary element of this urban and industrial landscape of bridges, granite bulkheads and dam structures. The remainder of the parcel (currently the site of the Charles River Building) would be developed as open space and would provide an extension of the pedestrian walkway along the Charles River.

Careful design of column and pier spacing can reduce impacts on views. Mitigating measures would include provision of landscaping on top of the below-grade ramp connecting the Central Artery and Storrow Drive.

Logan Airport

View from the Road

Motorists would be inside the tunnel structure until they merge onto the existing Airport roadway system; therefore, views would be of tunnel walls and other vehicles.

View of the Road

The only element of the project which would be visible at the Airport is the ventilation building to be located on Bird Island Flats. This would be seen primarily from the Massachusetts Technology Center, and would be taller than other structures in the area, but otherwise would not be inconsistent in shape or size.

Pedestrian Environment

The project would not have an impact on the pedestrian environment at Logan Airport.

3.11 SECTION 4(f) EVALUATION

Section 4(f) of the U.S. Department of Transportation Act of 1966 prohibits use of land from a significant publicly-owned park, recreation area, or wildlife or waterfowl refuge or any significant historic site unless it can be shown that (1) there are no feasible and prudent alternatives to the use of the land; and (2) the proposed action includes all possible planning to minimize harm to the property resulting from such use.

3.11.1 Parklands

There are two recreation areas affected by the Two-Lane Tunnel Concept.

Charles River Basin Reservation

Description

The Metropolitan District Commission (MDC) owns this 17,000-acre reservation along, and including, the Charles River, extending from the Old Charles River Dam in Boston to Watertown. Chapter 524 of the Acts of 1909 gives the MDC authority over structures on, across, over, or in the Charles River Basin. The MDC was authorized by Chapter 550 of the Acts of 1962 to acquire land downstream between the old dam and the new dam described in the section on Paul Revere Landing Park below; however, acquisition of property between the dams has not occurred. The playground extending from Leverett Circle to Cambridge Street and the Longfellow Bridge along the Boston side of the Charles River would be affected by the project, as would Leverett Circle. (See Figure 34.)

Facilities in the landscaped playground area include a pedestrian and bicycle path, two tennis courts, a swimming pool, a wading pool, a baseball field, a tot lot and a soccer/football field. Pedestrian access to this part of the reservation is from the pedestrian overpasses at Leverett Circle, Blossom Street, and Cambridge Street.

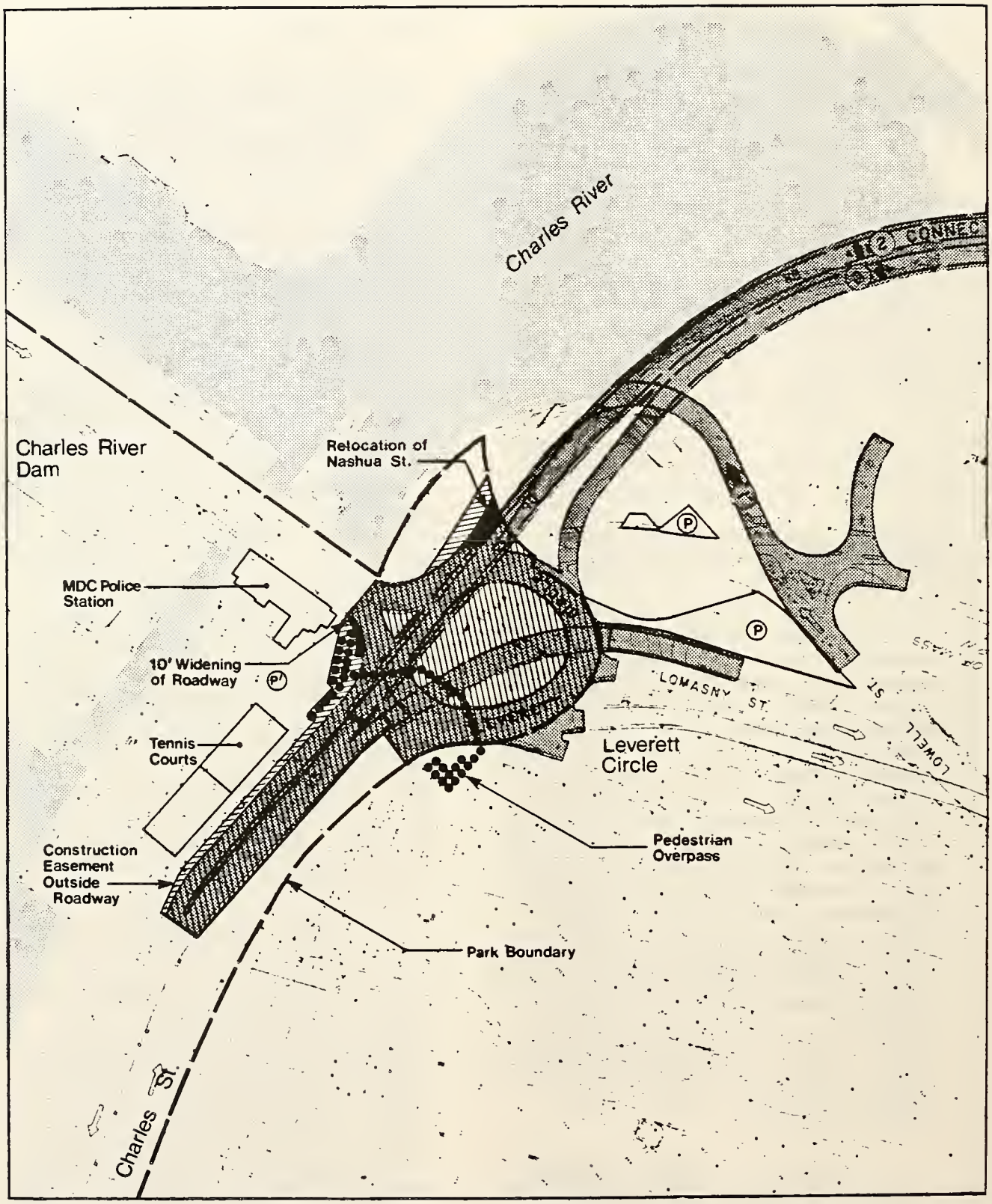
The park is heavily used by residents of the metropolitan area.

Location and Amount of Land to be Used

A strip of land up to 10 feet wide and approximately 50 feet long (less than 500 square feet in area), along the intersection of the Msgr. O'Brien Highway and Storrow Drive, would be permanently used for the reconfiguration of Leverett Circle. This strip is part of an MDC Police Station parking lot. A temporary construction easement which includes the existing roadway west of Leverett Circle and a 10-foot width along the roadway would be needed for a distance of approximately 500 feet, temporarily involving 5,000 square feet of parkland. This land would be used for a period of six months to one year, while the Storrow Drive/Central Artery connections are constructed. The affected area includes the pedestrian overpass at Leverett Circle, a narrow strip of land at the edge of the MDC police parking lot and the edge of the tot lot. The pedestrian overpass would be reinforced during construction, but would remain serviceable in its present location. At the end of construction in this area, the land would be returned to its original condition.

A new tunnel ramp from the Central Artery to Storrow Drive would be built through Leverett Circle, requiring temporary disruption of the Circle during construction. The interior of the existing traffic circle is presently a grass-covered area of approximately 32,000 square feet, and contains a bridge pier and entrances to the MBTA Green Line Science Park Station, which passes over the Circle; the portion of this area which would be disturbed during construction would be restored following construction.

The relocation of Nashua Street to improve the geometry of the traffic circle would require the permanent use



Park Boundary
Construction Easement
Tunnel or New Roadway
(P) MDC Land Used for MDPW Parking
(P') MDC Police Station Parking

Figure 34
Charles River Basin — Impacts

0 50 100 200 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

of an area within the Reservation approximately 30 feet wide and 100 feet long (3,000 square feet); this area is currently used by the Massachusetts Department of Public Works for surface parking, and is not presently available for park use. A 20-foot-wide construction easement would also be needed next to the relocated Nashua Street in the parking lot.

Other Impacts

During the construction period, there would be increased traffic congestion on the portion of Storrow Drive abutting the playground, and consequent increases in air pollution in and around the playground near Leverett Circle. After construction, Leverett Circle would have decreased traffic, reducing the traffic-related air and noise pollution in and around the playground.

Federal Agency Funding of Improvements

Although Land and Water Conservation Fund (LWCF) funds were expended for tennis courts in the reservation, this part of the park would not be disrupted by the Two-Lane Tunnel Concept.

Alternatives Which Would Avoid the Section 4(f) Property

The existing connection of the Central Artery to Storrow Drive at Leverett Circle, within the Reservation, is a necessary link in the regional transportation system at present and would continue to be a necessary link following completion of the project. Two types of alternatives to the Two-Lane Tunnel Concept were examined: (a) those which make the connection with Storrow Drive at another location, and (b) those which do not involve construction to modify the existing connection.

(a) The Two-Lane Tunnel Concept, while not avoiding the 4(f) property entirely, makes the connection with Storrow Drive in the location which involves the least impact to the Reservation. Storrow Drive lies entirely within the Reservation at its eastern edge and Leverett Circle at its northeastern corner, which is closest to the Central Artery; recreational and park facilities lie beyond these roadways. Consequently, any alternative connection to Storrow Drive would lie further into the Reservation and would involve larger amounts of 4(f) land and impacts to more recreational facilities.

(b) The No-Build Alternative, and other alternatives which included no Central Artery improvements were examined in the DEIS and SDEIS; these alternatives involve no construction in the Reservation and would avoid 4(f) property but do not satisfy the basic transportation objective of improving traffic flow on the Central Artery, and were rejected for this reason.

Design modifications to the Two-Lane Tunnel Concept which would involve no change in the present Central Artery connection to Storrow Drive at Leverett Circle were examined. These modifications would retain the existing two-lane underpass at the Circle by connecting all northbound and southbound Central Artery traffic to the existing ramp approach to Storrow Drive and eliminate the Two-Lane Tunnel Concept's minor modifications in surface road geometry at the Circle.

Careful examination of this alternative reveals that it may be possible to utilize the existing two-lane tunnel segment under Leverett Circle. However, it is clear that even with this possible modification there will still remain some construction period use of Leverett Circle, particularly at those locations where new ramps to local street connections will have to tie into the existing geometry of Leverett Circle. Use of a two-lane tunnel in this segment would have negative traffic characteristics compared with the three-lane tunnel incorporated

with the Preferred Alternative. Further design work may show that the two-lane tunnel segment is the appropriate solution.

Some Charles River Basin Reservation land will be used during the construction phase in either event, and is therefore covered under this Section 4(f) Evaluation.

Measures to Minimize Impacts

Standard construction mitigation techniques would be used to mitigate the relatively minor construction period effects. The temporarily used 10-foot strip of land along the edge of the park and the grassy area inside Leverett Circle will be restored to their original condition following construction.

Paul Revere Landing Park

Description

The MDC owns this 8.5-acre park around the New Charles River Dam at the head of the Charles River Basin in Boston. The park is part of the 17,000-acre Charles River Basin Reservation, but not contiguous to its other land. Paul Revere Landing Park extends from Boston's North Station area across the dam and into the Charlestown neighborhood. It consists of a landscaped parking and pedestrian area near North Station, the dam, and a park area in Charlestown (see Figure 35).

A landscaped pedestrian way bordering the parking area has two branches, one which runs a short distance along the Boston edge of the Charles River, while the other continues across the locks of the new dam and the pumping station and ends on the Charlestown side of the park. The parking area accommodates approximately 100 cars. The existing High-Level Bridge connecting the Central Artery with Interstate Route 93 crosses over part of the parking area and the locks at an elevation of approximately 40 feet to 50 feet to bottom of structure, depending on location.

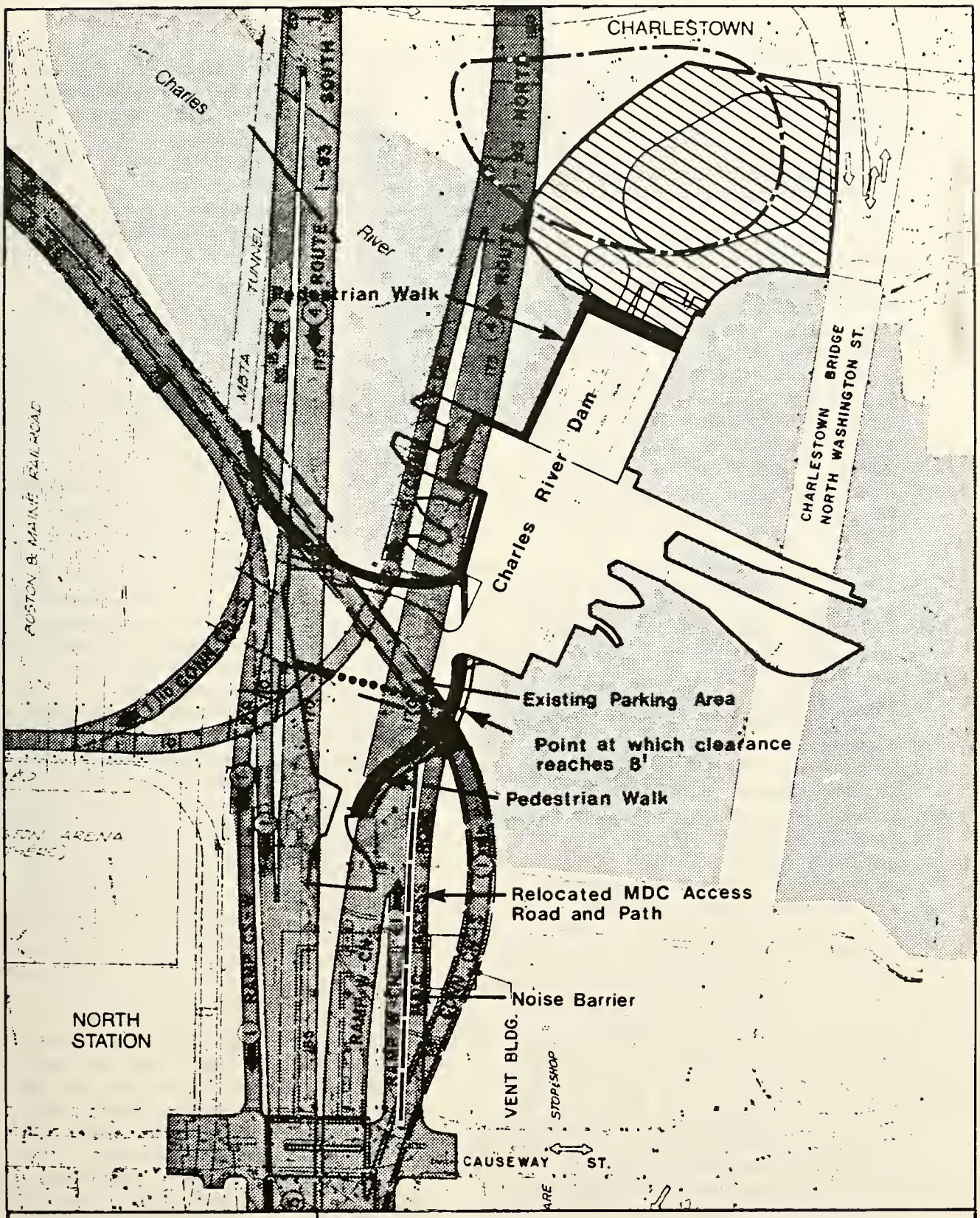
Although the MDC has conceptual plans to acquire and develop more land along both banks of the Charles River to create a greenbelt strip, of which Paul Revere Landing Park would be part, this land has not yet been acquired by the MDC, and it is not subject to 4(f) regulations. However, actions to further planned property acquisition for this greenbelt are included among the mitigating measures described below.

Pedestrian access to the park on the Charlestown side is by a stairway from the existing North Washington Street Bridge, from under this bridge, and from under the existing High-Level Bridge. On the North Station side of the river, pedestrian access is from Beverly Street, under the existing Central Artery viaduct. The pedestrian way is heavily used by area residents walking between Charlestown and downtown Boston.

Location and Amount of Land to be Used

The Charlestown side of the Paul Revere Landing Park is affected both by the Two-Lane Tunnel Concept of the present project and by the separate Central Artery North Area Project. The North Area Project involves reconstruction of the Interstate Route 93 viaduct and its approaches to Route 1. The preliminary design for the North Area Project involves surface street modifications that require the redesign of the Charlestown side of Paul Revere Landing Park into a larger, but reconfigured parcel.

The preliminary design for the North Area Project would have to be modified as a result of the Central Artery Depression Project; design coordination between the two projects involves the transition from the new Charles River bridges constructed in the Central Artery Depression Project to the new Interstate Route 93 viaduct constructed in the North Area Project. This transition occurs in the vicinity of the Paul Revere Landing Park.



Park Boundary

Tunnel or New Roadway

Area to be Designed During North Area Project Final Design

Boundary Under Preliminary North Area Design

Figure 35

Paul Revere Landing Park Impacts

0 50 100 200 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Construction activities (due to the Central Artery depression) on the Charlestown side of the Charles River affect MDPW-owned land to the west of the park, part of which has previously been pledged to become replacement park land following construction of the North Area Project. (See Figure 35.) The net effect of both projects on this part of the park would be to increase its area; the final configuration of the park would be determined following design coordination between the projects and consultation with the MDC. Impacts on the Charlestown side of the park are being detailed in the Section 4(f) Evaluation for the Central Artery North Area Project, which would be finalized during final design of the North Area Project, beginning in 1984.

The new MDC Charles River Dam and its parking area on the Boston side of the Charles River lie south of the Charlestown area just described. The existing High-Level Bridge would be replaced by two lower-level bridges connecting the depressed Central Artery to the Interstate Route 93 viaduct and its approaches to the Mystic-Tobin Bridge in Charlestown. The new connections would be constructed as open cut sections with four-foot walls, rising to ramps on retained fill, and then to low-level bridges 8 to 30 feet above the land and/or water. The land extending from the beginning of the open cut sections to the point at which the clearance under the bridges reaches eight feet would no longer be available for parking or pedestrian use which occurs at present. The area to be taken would be approximately 40,000 square feet. At the water's edge, there would be a 15-foot vertical clearance between the bottom of the bridges and the pedestrian path along the river's edge, which presently terminates at the western property line of the MDC land (see Figure 35).

Within the 40,000 square foot area just described, construction of the open cut sections and lower-level bridges also would result in the permanent taking and replacement in a new alignment of the existing park access road and the pedestrian walk leading to the dam. The Two-Lane Tunnel Concept also would include construction of subsurface ramps between the Central Artery and Storrow Drive which would require realignment of the existing Charles River bulkhead and the existing path along the river edge.

Other Impacts

A Leverett Circle ramp to Interstate Route 93 northbound would cross above the parking area (at a measured height of approximately 40 feet from bottom of structure); this ramp would cross over approximately 14,400 square feet of parkland. Cars and pedestrians would be able to move freely under this ramp.

The two new bridges across the Charles River would be approximately 23 feet above mean high water at the dam's recreational boat locks, and 30 feet above mean high water at the large commercial boat lock; this is lower than the existing High-Level Bridge, which is approximately 40 and 50 feet above mean high water at these respective locks. Navigation would not be affected by the new bridges. The northbound bridge would be 60 to 100 feet closer to the locks and pedestrian walkway over the pumping station than the existing High-Level Bridge. It would occupy approximately 1,600 square feet of air rights over the corner of the park on the Charlestown side of the river, and 29,400 square feet of air rights over the dam and property on the Boston side of the river, casting shadows on the dam. (The current High-Level Bridge casts shadows further upstream.) Additionally, each new bridge structure, as currently designed, would be approximately 58 feet from the underside of bridge to the top of truss, contributing to their visual impact. The shadow effect, and the proximity of the pedestrian walkway to traffic on the northbound bridge, would reduce the aesthetic quality of the walk and its public recreational value. Northbound

traffic on the ramps to the new bridges across the Charles River would increase noise levels at the park.

The construction of a ventilation structure on the site of the Charles River Building, adjacent to the park, would also have potential visual impacts in the park.

During the construction period, the MDC parking lot would be reduced to approximately one half its capacity for approximately one year.

Alternatives Which Would Avoid the Section 4(f) Property

Alternatives to the Two-Lane Tunnel Concept which would avoid or reduce impact on the 4(f) property are as follows: (a) alternatives which involve no improvements to the Central Artery, (b) modifications to the alignment of the Two-Lane Tunnel Concept, and (c) modifications to the profile of the Two-Lane Tunnel Concept.

(a) Removal of the existing bottleneck caused by the High-Level Bridge is one of the major objectives of the project. The No-Build Alternative and alternatives which do not include depressing the Central Artery and replacing the High-Level Bridge were examined in the DEIS and SDEIS; these alternatives did not satisfy the basic project objective of improving Central Artery traffic flow, and were rejected.

(b) The alignment for the proposed bridges closely parallels that of the existing bridge in a corridor that is tightly constrained by the need to connect the Central Artery to the south with the Interstate Route 93 viaduct and Route 1 to the north within a distance of less than 2,000 feet; the short distance between these points makes alternative bridge alignments to the west or east of this park impossible. The existence of the Orange Line tunnel makes it impossible to shift the bridges to the west. Shifting the bridges to the east would cause greater impacts to the Charles River Dam, which is part of the 4(f) property, as well as to the Stop and Shop Bakery Building and other buildings in the Causeway-North Washington Streets District, which is a separate 4(f) area described in Section 3.11.2.

(c) The bridge profile is similarly constrained. If the Central Artery crossing of the Charles River were placed in a tunnel underneath the river, to completely avoid surface and air rights use of 4(f) parkland, the depressed roadway's profile would not meet that of the existing Interstate Route 93 until Sullivan Square, approximately 5,000 feet north of the Two-Lane Tunnel Concept's northern limit. Connection at this point would make connection to the Mystic-Tobin Bridge (Route 1) impossible.

Higher profiles for the Charles River bridges were considered and rejected because they would not avoid the 4(f) property. Although higher bridge profiles would reduce some of the visual impacts to the 4(f) property, this modification would cause other impacts, including impacts to 4(f) historic districts, disproportionate to their benefit to the Paul Revere Landing Park. Higher bridges would require relocation of Causeway Street and the removal of the existing Central Artery structure prior to the construction of the new bridges; maintaining continuous operation of the Central Artery during construction would therefore not be possible. Benefits to the North End and the Bulfinch Triangle Districts, both of them potentially eligible historic districts subject to Section 4(f), from the removal of the existing Central Artery viaduct in the Two-Lane Tunnel Concept include removal of visual impacts of the structure, reconnection of historic streets, and improved pedestrian access.

Mitigating Measures

A new MDC access road with a sidewalk for pedestrians would be built northeast of the existing access road. A reconfigured bulkhead would

also be built far enough into the water to accommodate a new riverfront pedestrian walk. The parking lot would be reconfigured to accommodate 100 spaces, the number in the existing lot. Replacement facilities would be landscaped to mitigate visual impacts of the project.

Design modifications to the two bridges could potentially result in more attractive bridges, reducing shadows on the pedestrian walk. Modifications could include the use of a cable suspension design to lighten the bridge superstructure or improvements to the underside of the bridge structure such as lighting. The feasibility of bridge design alternatives would be studied during later design phases. Work on the final design would involve consultation between the MDPW, MDC, FHWA, and other Federal agencies with jurisdiction over waterways (U.S. Army Corps of Engineers; U.S. Department of Interior, Fish and Wildlife Service; U.S. Coast Guard).

The ventilation building adjacent to the park would receive architectural and landscape treatment to minimize visual impacts on the park.

A noise barrier constructed along the western edge of the park access road and pedestrian walk would provide a noise and visual buffer between this road and the adjacent Central Artery northbound on-ramp.

As discussed above in the description of the 4(f) property, the MDC has plans to acquire riverfront property to create a greenbelt connecting Paul Revere Landing Park with the Charles River Reservation further upstream. EOTC and MDPW would continue to work closely with the MDC to seek to facilitate park land acquisitions as a measure to offset visual and other impacts of the Two-Lane Tunnel Concept on Paul Revere Landing Park. Suitable remnants of parcels acquired for right-of-way for the project or the related North Area Project would be made available to the MDC for park use.

3.11.2 Historic Resources

Of the historic resources discussed previously in Section 3.9 which are either listed on the National Register of Historic Places or potentially eligible for the Register, the resources listed below would be directly affected by one or more project alternatives. For a more detailed discussion of these and other resources in the project area, see Section 3.9 Historic Resources; for a discussion of indirectly affected historic resources, and the Section 106 review process, see also Section 3.9.

The historic resources discussed in this section are shown on Figure 33.

Charles River Basin District

Description

This National Register District is owned by the Metropolitan District Commission; it occupies much of the Charles River Reservation. It includes the river, its banks, bridges, and park land from the old Charles River Dam in the project area to the Eliot Bridge, six miles upstream. Among its contributing features are the MDC police headquarters at the Boston side of the dam, and the MBTA's concrete arch viaduct to Cambridge.

For a detailed analysis of long-term and construction impacts, mitigating measures, and alternatives which would avoid the Charles River Basin District, see Section 3.11.1. The character of the area would not be changed by the project after completion of construction, and the FHWA and the State Historic Preservation Officer have concurred in a Finding of No Effect on this District (see 7 September 1983 letter in COMMENTS AND COORDINATION in the FEIS).

Causeway - North Washington Streets District

Description

This potential historic district comprises late nineteenth and early twentieth-century five- to seven-story brick buildings with notable brick, stone, and metal detailing; they were constructed for a variety of mercantile and manufacturing purposes. The Charles River Building (1907 and 1909) at 131 Beverly Street is similar in size, materials and detailing to the attached Hoffman Building and the adjacent Stop and Shop Bakery. None of these buildings is individually eligible for the National Register. The district includes the eastern half of the original Bulfinch Triangle, which is divided by the elevated Central Artery and MBTA Green Line structures.

Location and Amount of Land to be Used

The alignment of the Two-Lane Tunnel Concept requires the taking of the Charles River Building and the loading dock at the west end of the Stop and Shop Bakery Building for construction of a connecting ramp from the depressed Central Artery northbound to Storrow Drive. The tight corridor and required horizontal geometry of the ramp necessitates this alignment (see Figure 36). Because of its position in relation to the Stop & Shop Bakery Building and the Hoffman Building, and the limited number of buildings in the area, removal of the Charles River Building would further permanently alter the historic fabric and character of an area which has already been negatively affected by construction of the existing Central Artery viaduct. Approximately 0.9 acres of the total 6.7 acre district will be affected.

Other Impacts

These alternatives would also have the positive impact of removing the Central Artery viaduct from the historic Bulfinch Triangle area and partially reuniting the Causeway-North Washington Streets District with the Bulfinch Triangle to the west, a potentially eligible National Register District.

A 10-story ventilation building measuring approximately 60 feet by 80 feet would be built on the former site of the Charles River Building. This new building would not be out of character with the surrounding industrial area.

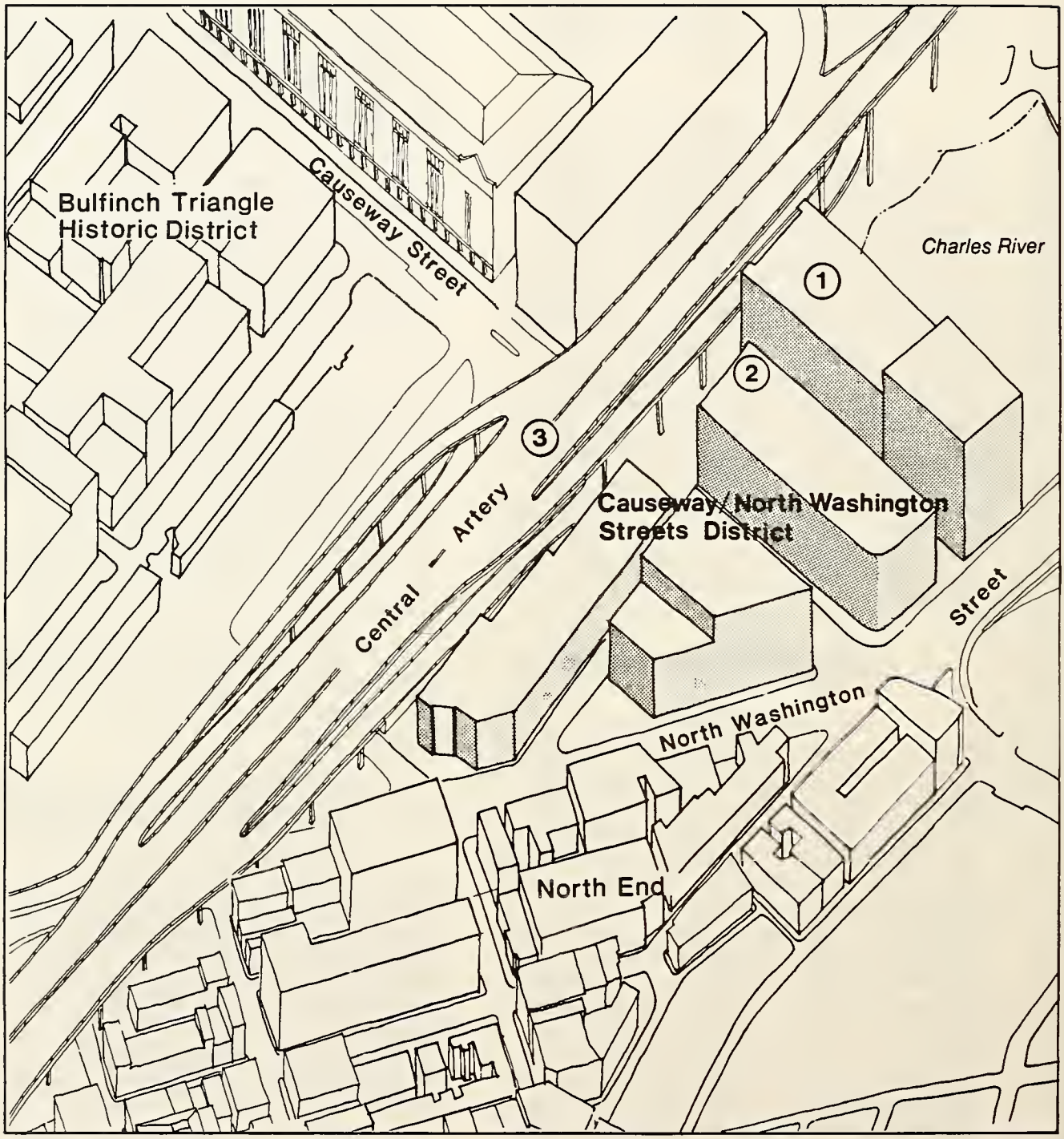
Other long-term indirect impacts consist of increased traffic through the area via existing streets and the proposed Surface Artery and Central Artery ramps, which would partially isolate the District, thereby reducing its economic viability and increasing the potential for loss of its other historic buildings.

The construction-period impacts consist of traffic congestion, vibration, and construction disruption.

Alternatives Which Would Avoid the Potential 4(f) Property

Alternatives which would avoid or reduce use of the potential 4(f) property are as follows: (a) the No-Build Alternative and other alternatives which do not improve the Central Artery, (b) modifications to the Two-Lane Tunnel Concept's alignment, and (c) underpinning of the Charles River building and relocation of the proposed ventilation structure.

(a) Improved traffic flow between the Central Artery and Storrow Drive, Interstate Route 93 in Charlestown, and the Mystic-Tobin Bridge is a primary objective of the project. Alternatives which did not include depressing the Central Artery and replacing the High-Level Bridge were also examined. Because these alternatives did not satisfy the stated transportation objective of improved traffic flow on the Central Artery and between the Central Artery



1 Charles River Building to be taken (future site of ten story, 60′ x 80′ Ventilation Building)	Figure 36
2 Stop & Shop Bakery loading dock* to be modified	Impacts on the Causeway/North Washington Streets Historic District
3 Central Artery viaduct to be removed, partially reuniting district with Bulfinch Triangle	0 50 100 200 Feet
*Not Visible in Drawing	EIS/EIR for I-90 –Third Harbor Tunnel; I-93 – Central Artery

and Interstate Route 93, the Mystic Tobin Bridge, and Storrow Drive, they were rejected from further consideration.

(b) Design modifications to the Central Artery to Storrow Drive ramp alignment were examined; these modifications involved either relocating the ramp to the south of the District or relocating it to the north of the District.

There are several constraints that affect realignment of the ramp to the south. Realignment in this direction must be to North Washington Street on the opposite side of the district from the Two-Lane Tunnel Concept (alignments between North Washington Street and the Two-Lane Tunnel Concept go through the middle of the District and increase the amount of 4(f) property affected). Realignment to beneath North Washington Street requires that the ramp diverge from the northbound Central Artery just north of the Sumner Tunnel connection with the Artery. This realignment of the Storrow Drive exit ramp would overlap with the northbound entrance ramp from the Sumner Tunnel, making it impossible for traffic from the Sumner Tunnel to reach Storrow Drive. In addition, relocation of the Storrow Drive ramp to the south of the 4(f) District would involve a circuitous alignment passing to the east of the District and across the Charles River to avoid the Orange Line Tunnel, the foundations of both the North Washington Street Bridge and the New Charles River Dam, the Paul Revere Landing Park, and the complex system of ramps in the North Area Project before turning back to cross the river a second time and connect with Storrow Drive.

The alternative of relocating the ramp to the north of the 4(f) District involves similar conflicts with the new Central Artery bridge foundations, the Charles River Dam, Paul Revere Landing Park, and/or the ramp system in the North Area Project.

A further ramp alignment alternative would utilize a sharper turning radius to accomplish the left-turn movement (from Artery northbound to Storrow Drive westbound) with reduced land taking impact to the east. Specifically, design refinement studies suggest that the loading dock of the Stop & Shop Bakery Building would still be taken or underpinned. In this design alternative, land included in the potential historic district (i.e., the loading dock of the Bakery Building) would still be used, but the overall net impact would be significantly less. However, because of this expected "use" of the land included within the potential historic district, the procedures of Section 4(f) would continue to be applicable to this alternative.

In summary, the alternatives of relocating the Storrow Drive ramp connection either to the north or south of the Causeway-North Washington Streets District were rejected because of conflicts with major traffic movements and/or conflicts with several major structures which must be crossed by such alignments.

(c) The possibility of retaining the current alignment and underpinning the Charles River Building, rather than taking it was examined. This alternative was rejected for several reasons: the cost of underpinning the building would be approximately $5 million; portions of the building would have to be vacated during the complicated and lengthy underpinning operations; and construction of the depressed Central Artery and the MDC Access Road would still require taking the access and loading area for the building, necessitating changes in the use of the building, and possibly harming the economic feasibility of maintaining the building. The location of the proposed ventilation building would also have to be revised because it it presently proposed for the Charles River Building site. The MBTA's Orange Line Tunnel prohibits constructing the ventilation building

west of the Central Artery. As indicated in Section 3.6.5, violations of the Commonwealth's policy level for NO_2 emissions from the proposed ventilation buildings require additional detailed air quality modeling and analysis to mitigate this impact. The final location of this building will be determined in accordance with these analyses, and also in conformance with the Section 106 Memorandum of Agreement. It should be noted, however, that a different site would also lie either within this District, possibly requiring taking another building, or in the Charles River.

Mitigating Measures

Further design activity should focus on actions which allow the Charles River Building to remain. Design refinements as noted above suggest that modifications to the radius of curvature of the ramp from the Central Artery northbound to Storrow Drive westbound may obviate the need for the taking of the Charles River Building. The Stop and Shop Bakery Building loading facilities would be modified either to allow continued operations or to serve an alternative building use with lesser loading requirements, such as office or lighter industrial uses, which occupy the adjacent Hoffman Building. Historic documentation of these two buildings would be done as approved by the Historic American Building Survey/Historic American Engineering Record (HABS/HAER) prior to alteration or displacement (see the Section 106 Memorandum of Agreement in COMMENTS AND COORDINATION in the FEIS/FEIR).

Construction staging and traffic management measures would be used to reduce impacts during construction. Vibration impacts within the District would be mitigated through measures such as water jetting, pre-trenching, and pre-augering of piles and maximum use of slurry wall construction, as described in Section 3.7.2 Vibration Impacts, and through appropriate design of construction staging and contract specifications to avoid structural damage, as provided in the Section 106 MOA.

Design guidelines for the development of the ventilation structure would be developed by the MDPW, in consultation with the Massachusetts SHPO and BLC, as provided in the Section 106 MOA.

Fort Point Channel District

Description

Fort Point Channel, a potential National Register District, is described in Section 3.9. It includes the Channel waterway and bulkhead, four significant bridges, and the sub-area of brick warehouses in South Boston developed (1880-1930) by the Boston Wharf Company.

Location and Amount of Land to be Used and Other Impacts

The Two-Lane Tunnel Concept would shorten the Channel to Mt. Washington Street. Additionally, in this alternative, no deck would be placed on top of the tunnel structure in the Channel, reducing visual impacts and alterations to the bulkhead and historic Summer Street and Congress Street bridges, but also making the tunnel structure itself visible at low tide from Congress Street to the south end of the waterway. This situation is not altogether inconsistent with the present character of the Channel, in which bottom shoals and submerged structures are exposed at low tide.

Of the structures which span the Channel, only one would be removed under the Two-Lane Tunnel Concept; this is the Old Colony Bridge. The bridges at Congress and Summer Street would have their portions on the Boston side of the Channel dismantled and reconstructed, and would be rebuilt in a manner consistent with the structures' original profiles.

The Two-Lane Tunnel Concept, which involves the construction of a

tunnel along the Seaport Access alignment, would use 67,300 square feet of land in the Boston Wharf section of the district. This alternative would require that two buildings (40 Wormwood Street and 293 A Street) in the Boston Wharf Company section of the Fort Point Channel District be taken. Although each has contributed historically to the development of this district, neither is architecturally significant, and neither is individually eligible for the National Register.

During construction, the Two-Lane Tunnel Concept would alter vehicular and water access to the Fort Point Channel as a result of successive closings or reductions in width of the bridges, and the use of temporary bridge structures; the placement of steel sheeting in the Channel; and the presence of barges and construction equipment.

There would be additional construction impacts in the Boston Wharf Company section of the Fort Point Channel District. Although these are industrial and commercial neighborhoods, the Two-Lane Tunnel Concept would create additional short-term noise, dust, and vibration impacts on these areas' buildings, a number of which have been recently rehabilitated.

Alternatives Which Would Avoid the Section 4(f) Property

No alternative which provides a cross-harbor tunnel connection can entirely avoid the southern end of the Fort Point Channel District and the historic Old Colony Railroad Bridge because of the need to connect with the Massachusetts Turnpike, whose terminus lies immediately west of the Channel District. An alignment which crossed the Fort Point Channel area at a location south of the Gillette property was examined and rejected. This alternative is operationally infeasible, since it requires the highway tunnel to pass under the MBTA Red Line tunnel and then to rise to connect to the Massachusetts Turnpike. This alignment is not possible in the short distance allowed for this connection. Alternatives which did not include a cross-harbor tunnel connection were examined in the DEIS and SDEIS; they did not provide the desired traffic improvements on the Central Artery and in the existing tunnels, and were rejected.

A second major objective of the project, providing additional north-south expressway capacity in this segment of the Central Artery corridor, requires construction in the Channel District with all build alternatives studied in both the DEIS and the SDEIS. Alternatives which did not include providing additional capacity in this segment of the Central Artery were examined in the DEIS and SDEIS; they did not provide the desired traffic improvements on the Central Artery, and were rejected. Other alternatives which would avoid or reduce this use of land within the district were considered. Specifically, conceptual feasibility studies were made during the preparation of the SDEIS of (a) widening the Dewey Square Tunnel, (b) construction of a new four-lane tunnel beneath Atlantic Avenue, (c) construction of the Central Artery northbound tunnel under existing Dorchester Avenue on Postal Service land, and (d) elimination from the project of additional Central Artery capacity in the Dewey Square area.

(a) Widening of Dewey Square Tunnel was considered and rejected because widening this tunnel would cause extensive commercial relocations in the Leather District and Chinatown and residential relocations in Chinatown (a total of 27 relocations and/or underpinnings); these takings would occur within the potentially eligible Chinatown Historic District and the eligible Leather District, which experience no effect with the Two-Lane Tunnel Concept. There would also be 4(f) impacts to the Chinese Gate park and the adjacent basketball court.

Options (b) and (c) were

discussed in the SDEIS, and were rejected because they would not provide the desired traffic service for traffic entering the city from the south, had undesirable geometric features on the Interstate highway, and had major potential effects on the South Postal Annex and the South Station Red Line facilities.

(d) The concept of not expanding north-south capacity in this segment of the Central Artery corridor was studied; i.e., leaving the existing Dewey Square tunnel with six lanes and omitting the northbound lanes from Fort Point Channel. This concept would fail to satisfy the transportation objective of improving Central Artery traffic flow and reducing congestion. Demand at Dewey Square would exceed capacity by 25 percent during peak hours and by 10 to 15 percent in the hours immediately before and after peak. Significant queueing would result and traffic flows would be disrupted throughout the Central Artery and on local streets in Downtown Boston and South Boston due to substantial traffic diversion from the Central Artery. Also, this concept does not avoid construction along the Fort Point Channel, since a pile-supported new Dorchester Avenue would still be above the Channel to provide access from the south to the Central Business District (the need for this is reinforced by the reduced capacity of the Dewey Square Tunnel).

Mitigating Measures

Long-term mitigating measures include configuration of the ventilation building to reduce visual impact, use of granite facing to make the new bulkhead sections visually consistent with the existing bulkhead, reconstruction of existing bridges, and the creation of landscaping improvements and a pedestrian walkway along the Boston side of the Channel.

3.11.3 Archaeological Sites

A Phase I, Step 1 archaeological survey has been performed for the project. The Phase I, Step 1 survey results indicated a high probability of locating archaeological resources in the following areas: South Bay/South Cove, Fort Point Channel, Fort Hill, Central Artery corridor from Dewey Square to Causeway Street, Logan Airport, and South Boston corridor.

As stated in the Section 106 Memorandum of Agreement (MOA), FHWA would ensure that a Phase I, Step 2/Phase II investigation is initiated 90 days following ratification of the 106 MOA and release of funds for additional planning and design studies. This investigation would include, at a minimum, the following elements:

o preparation of an appropriate research design, outlining and justifying important research problems that may be addressed by investigation of archaeological properties in the project area, and a proposed scope of work and work plan for field investigation integrating the results of the following work:

acquisition of additional historical documentary information on past disturbances that may preclude areas from field testing, and

acquisition of additional historical documentary information concerning potential significance of historic and prehistoric archaeological remains.

This program for investigation, including the research design, scope of work and work plan would be reviewed by MDPW and the SHPO prior to implementation.

o Field testing and evaluation would be implemented based on the scope of work and work plan and in the context of the research design.

o A written report describing the results of the documentary research, field testing and applied National

Register criteria and containing recommendations on the significance of identified resources, would be provided to MDPW, the Massachusetts SHPO, and BLC. These recommendations would be subject to review by MDPW and the Massachusetts SHPO in consultation with BLC.

Based on the results of the documentary research and field testing work, a plan would be developed in consultation with the SHPO and BLC that includes provisions for avoidance or preservation in place of significant archaeological remains, where feasible and practical, through design and engineering development or construction specifications as set forth above. If avoidance or preservation in place is not feasible and practical, and the SHPO concurs in this determination, the plan would include provisions for Phase III data recovery or other appropriate treatment. The plan would be submitted to the Massachusetts SHPO and the Advisory Council for review and approval in consultation with BLC prior to implementation.

At such time as the nature, extent, and locations of necessary utility line relocations are known, identification, evaluation, and treatment plan preparation and implementation would be done in the same manner as set forth above for any significant archaeological properties which may be affected by these activities.

All historic and archaeological investigations called for under these stipulations would be conducted by individuals who meet, and in a manner consistent with, the Advisory Council's standards and guidelines.

3.11.4 Consultation

Consultation regarding the above parkland and historic sites, as required by federal 4(f) regulations, was initiated during the DEIS/DEIR through meetings and discussions with Federal, State and local agencies. This consultation process has continued during the preparation of the FEIS/FEIR. For a description of the results of this consultation, and documentation of these results, see CHAPTER 5.0 SECTION 4(f) EVALUATION and COMMENTS AND COORDINATION in the FEIS/FEIR.

PART 2:
OPTIONAL FORT POINT CHANNEL CONCEPTS

TABLE OF CONTENTS

		Page
1.0	Introduction	1
2.0	Atlantic Avenue Concept	1
2.1	Engineering Description	1
2.1.1	Alignment	1
2.1.2	Property and Utilities	1
2.1.3	Stage Construction	4
2.1.4	Geology and Soils	6
2.1.5	Ventilation	7
2.1.6	Power	7
2.1.7	Project Costs	7
2.1.8	Energy	7
2.1.9	Design Criteria	7
2.2	Environmental Consequences	8
2.2.1	Transportation	8
2.2.2	Land Use and Economic Impacts	8
2.2.3	Neighborhood and Community Facilities Impacts	8
2.2.4	Air Quality	9
2.2.5	Noise and Vibration	9
2.2.6	Water Resources	9
2.2.7	Section 4(f) Impacts	9
3.0	Dorchester Avenue Concept	9
3.1	Engineering Description	9
3.2	Environmental Consequences	10
3.2.1	Transportation	10
3.2.2	Right-of-Way	10

LIST OF FIGURES

Figure No.	Description	Page
1	Atlantic Avenue Study - South Bay Area	11
2	Atlantic Avenue Study - Central Area	12
3	Atlantic Avenue/Dorchester Avenue Concepts - Typical Sections - South Bay Area	13

1.0 INTRODUCTION

The Massachusetts Department of Public Works has evaluated several concepts which avoid placing the northbound Central Artery tunnel (the northbound portion of the "split alignment") in the Fort Point Channel. The Widening Alternative, discussed in the Supplement to the DEIS/DEIR (p. 17-28), was one option which was eliminated after evaluation of its impacts. Two other options have since been evaluated: (1) constructing the tunnel beneath the existing Atlantic Avenue corridor; and (2) constructing the tunnel beneath the existing Dorchester Avenue corridor, abutting but not in the Fort Point Channel. These options have also been eliminated from further consideration due to their adverse effects on abutting parcels, in addition to other undesirable consequences.

Attempts to avoid Section 4(f) impacts to the Fort Point Channel have been rendered somewhat moot by the necessity of providing a relocated Dorchester Avenue that will connect the South Bay area to downtown Boston. Existing Dorchester Avenue from Summer Street to South Bay is currently the property of the U.S. Government and is closed to the public. The U.S. Postal Service's South Postal Annex requires this portion of Dorchester Avenue for access to its truck loading bays and for maneuvering and parking space. Maintaining Dorchester Avenue as a private way is absolutely vital to the continuation of services at the South Postal Annex. Accordingly, a public Dorchester Avenue in this area would have to be relocated in the Fort Point Channel, given that access to the Post Office cannot be blocked as it would be on the plans for the Atlantic Avenue Concept (see Figures 1 and 2). Figure 3 presents typical roadway cross- sections. The new Dorchester Avenue roadway would be pile supported and would extend approximately 35 feet into the Channel. The addition of a tunnel box beneath reconstructed Dorchester Avenue and essentially covered by water would not have substantially more impact on the Channel. Since some impact on Section 4(f) lands is unavoidable, the disadvantages of the tunnel alignments which avoid the Fort Point Channel assume additional weight.

2.0 ATLANTIC AVENUE CONCEPT

2.1 ENGINEERING DESCRIPTION

The discussions that follow are limited in focus to the area bordered by Broadway, Fort Point Channel, Northern Avenue and the Central Artery. Beyond this area, the engineering description of the Atlantic Avenue Concept is identical to that for Alternative 5A as described in the SDEIS/DEIR.

2.1.1 Alignment

The tunnel structure containing the northbound roadway of the Central Artery would leave South Bay and pass beneath land owned by the Massachusetts Turnpike Authority (MTA) and the Massachusetts Bay Transportation Authority (MBTA), south of Kneeland Street and west of the South Station railroad trackage. The tunnel would then pass beneath Atlantic Avenue from the vicinity of Kneeland Street to Northern Avenue. It would join the alignment of the northbound roadway of the depressed Central Artery north of Northern Avenue. The geometry of certain ramps in South Bay would require a modification from that detailed for Alternative 5A, but all connections would be provided within the same general area.

2.1.2 Property and Utilities

Two structures conflict with the proposed alignment for the northbound Central Artery tunnel beneath Atlantic Avenue: the MBTA Red Line station at South Station and a below-grade portion of the Federal Reserve Bank building. The cost of reconstructing the Red Line Station would range from $20 to $30 million. Acquisition of approximately 2,600

square feet of the underground levels of the Federal Reserve Bank building would cost approximately $1 million. An additional 17 buildings have been identified which might require underpinning or other protective measures. The costs for the geotechnical aspects of the work would range as follows: $10 to $17 million for underpinning, and $35 to $40 million for lateral support. Probable impacts to abutters are discussed further below.

MBTA Red Line - South Station

The MBTA is currently developing plans to modernize the Red Line station, extend platforms and provide a direct underground connection to the headhouse of the South Station Transportation Center. Kiosks in each of the four corners of Dewey Square will improve pedestrian access to the Red Line and South Station and reduce pedestrian/vehicular conflicts. Construction is scheduled to be complete in 1985. The tunnel structure would pass through the mezzanine/lobby level of the station and displace an area of approximately 12,000 square feet to a depth of about 30 feet. This would require a complete redesign of the station and its connections to the Transportation Center, and would result in an underground network that would be redundant and less direct. Plans for the renovation of South Station, now under construction and scheduled to be complete by the end of 1986, would have to be revised since the connection from the Red Line would have to enter the basement at a different location. Dewey Square, the Red Line and South Station would be disrupted for the next three years during the planned reconstructions. This disruption would be extended and exacerbated for at least another three years, should an Atlantic Avenue alignment be selected.

South Station Transportation Center

The MBTA, BRA and Federal Railroad Administration (FRA) have begun the development of an intermodal transportation center at South Station which will provide intercity and commuter bus and train service, and a 2000-space parking garage. Future joint development plans include a 600-unit hotel and office, light manufacturing, and retail space. The historically significant South Station headhouse will be renovated as part of this project. Vehicular access will be aided by realignment of the terminus of the Massachusetts Turnpike to meet Atlantic Avenue, which will be made one-way in the northbound direction. Renovation of the headhouse, realignment of tracks and platforms, construction of the first level of air-rights structure and several ramp structures are scheduled to be complete by the end of 1988.

The tunnel structure would not conflict with the South Station headhouse nor the proposed air rights structures, but would conflict with the foundations for some of the ramp structures. Since this South Station construction is scheduled for the last phase (January 1987 to December 1988) of that project, coordination with the Atlantic Avenue construction of the northbound Central Artery tunnel would be possible to minimize these conflicts. However, loss of vehicular access from Atlantic Avenue, Dewey Square and Summer Street during tunnel construction would interfere with the functioning of the Transportation Center. The difficulty of maintaining connections to the MBTA Red Line Station at South Station would further undermine the intermodal transfer function of the Transportation Center. The potential also exists for vibrational damage to the headhouse structure and the deterioration of the spruce piles supporting the headhouse, should the water table be lowered.

The Leather District

Functional impacts during construction would occur at several buildings along Atlantic Avenue, with addresses at 186, 192-194 and 210 South Street, and 711, 717, 727-729,

745, 751-753 Atlantic Avenue, between Kneeland Street and East Street. These structures are part of the historic Leather District. Physical impacts to the buildings are not anticipated, but access to the loading docks which permit vital truck service would be eliminated or severely restricted by the closure of Atlantic Avenue to all but emergency vehicles. This may cause some truck-dependent businesses to relocate, and would interfere with the renovations and new businesses locating in this historic district.

Essex Hotel

The Essex Hotel would lose access from Atlantic Avenue during construction. Access from Essex Street would remain available.

Federal Reserve Bank Building

The tunnel structure would pass through the westerly corner of the underground levels of the Federal Reserve Bank building. Approximately 2,600 square feet would be taken.

Wang Building

Wang Laboratories has leased a portion of MTA land for construction of a building scheduled to commence in October of 1983. The lease agreement includes access to air-rights for future development. Although the tunnel structure would probably not conflict with the building, parking and access would be restricted during construction of the tunnel. The tunnel would also constrain the type and size of future air-rights development structures since the area available for foundations would be limited by the presence of the tunnel.

Dewey Square Office Tower

The tunnel structure would not conflict with the Dewey Square Office Tower, but loss of vehicular access from Atlantic Avenue would occur during construction.

Trailways Terminal

The tunnel structure would pass beneath the Trailways Terminal, but the building could be underpinned during construction and remain in service. Access from Atlantic Avenue would be lost during construction, forcing buses to enter and exit via Congress Street. Trailways operations will be moved to the South Station Transportation Center when that facility becomes functional.

Russia Wharf

The tunnel structure would not conflict with the building proper, although vehicular access from Atlantic Avenue would probably be denied during construction. There would be no land taking.

Edison Substation

The tunnel structure would not conflict with the substation, but vehicular access to the parking area from Atlantic Avenue would probably be denied during construction. There would be no land taking.

Harbor Plaza

The tunnel structure would not conflict with the building proper, although vehicular access from Atlantic Avenue would probably be denied during construction. There would be no land taking.

Hook Lobster

The tunnel structure would not conflict with either the building or the parking area, although vehicular access from Atlantic Avenue would probably be denied during construction. There would be no land taking.

Utility Relocations

The construction of the northbound Central Artery tunnel in Atlantic Avenue from Kneeland Street to Northern Avenue would require the total reconstruction of the existing major and minor utilities in the area. The proposed tunnel alignment would not allow the replacement of some of these utilities in Atlantic Avenue, especially sewer and drain

lines. The new East Side Interceptor sewer proposed for Atlantic Avenue would have to be relocated, either in Dorchester Avenue (which would have severe operational effects on the South Postal Annex), or in the Fort Point Channel (below the relocated Dorchester Avenue).

The total estimated cost for major utility work would range from $20 to $30 million.

2.1.3 Stage Construction

Since Atlantic Avenue would have to be closed to traffic during the construction of the tunnel structure containing the northbound roadway of the Central Artery, the construction staging plan that follows attempts to keep as much of this vital roadway in service for as long as possible. (The Atlantic Avenue construction area would probably be decked over to provide an area for construction equipment and materials and as a route for emergency vehicles. All other vehicles would probably be excluded.) This construction would have a duration of two to three years. (Reference is made to Figures 1 and 2 for identification of appropriate roadway and ramp elements.)

SEQUENCE I - Construct the northbound Central Artery Tunnel between Dewey Square and Northern Avenue.

1. Construct a temporary roadway through Dewey Square to permit right turns from Summer Street to Purchase Street. Construct a temporary roadway between Purchase Street and Atlantic Avenue near High Street. Also relocate the East Side Interceptor Sewer and New Dorchester Avenue (pile supported) to the Fort Point Channel.

2. Make Purchase Street one-way northbound.

3. Detour Congress Street traffic to Dorchester Avenue and Summer Street.

4. Close Atlantic Avenue between Dewey Square and Northern Avenue. Close northbound on and off-ramps between Congress Street and Northern Avenue. Close Congress Street between Purchase Street and Atlantic Avenue except to Trailways traffic.

5. Construct utility relocations, temporary and permanent, for those facilities in Atlantic Avenue and Congress Street.

6. Construct the northbound Central Artery Tunnel between Dewey Square and Northern Avenue.

   a. Construct that section of Tunnel beneath Congress Street first so that Congress Street can be reopened.

   b. Underpin the Trailways Terminal.

   c. Reconstruct the underground westerly corner of the Federal Reserve Bank building.

   d. Remove portions of the existing Central Artery northbound ramps between Congress Street and Northern Avenue.

7. Reconstruct those utilities that will be returned to Atlantic Avenue above or beside the tunnel structure.

8. Reconstruct Atlantic Avenue and re-open to traffic.

9. Return Purchase Street to one-way southbound operation.

10. Remove temporary roadways.

SEQUENCE II - Construct the northbound Central Artery Tunnel from Essex Street through Dewey Square.

1. Construct a temporary roadway to the west of Dewey Square between the northbound Surface Artery and Atlantic Avenue.

2. Make Congress Street two-way between Purchase Street and Atlantic Avenue.

3. Detour Summer Street traffic to Dorchester Avenue and Congress Street to Purchase Street, and from northbound Surface Artery.

4. Detour Atlantic Avenue traffic to Essex Street and Surface Artery.

5. Close Atlantic Avenue from Essex Street through Dewey Square.

6. Close Summer Street to through traffic between Dewey Square and Dorchester Avenue.

7. Construct utility relocations, temporary and permanent, for those facilities in Atlantic Avenue and Summer Street.

8. Reconstruct the MBTA Red Line station under Dewey Square.

9. Construct the northbound Central Artery tunnel from Essex Street through Dewey Square.

10. Reconstruct those utilities that will be returned to Dewey Square above or beside the tunnel structure.

11. Reconstruct Atlantic Avenue and Dewey Square and re-open to traffic.

12. Return Congress Street to one-way eastbound between Purchase Street and Atlantic Avenue.

13. Remove temporary roadways.

SEQUENCE III - <u>Construct the northbound Central Artery tunnel from Kneeland Street to Essex Street</u>.

1. Construct a temporary roadway from Ramp E of the Massachusetts Turnpike to Kneeland Street opposite South Street. Make South Street one-way northbound.

2. Close Atlantic Avenue from Kneeland Street to Essex Street. (Atlantic Avenue could be closed block by block in three phases so that interruptions of truck service to the Leather District is minimized. The sequence that follows is for the entire section, but could be applied to each block.)

3. Construct utility relocations, temporary and permanent, for those facilities in Atlantic Avenue and Kneeland Street.

4. Construct the northbound Central Artery tunnel from South of Kneeland Street to Essex Street. Construct foundations for the twin helical ramps at the South Station Transportation Center concurrently.

5. Reconstruct those utilities that will be returned to Atlantic Avenue and Kneeland Street above or beside the tunnel structure.

6. Reconstruct Atlantic Avenue, Kneeland Street and Ramp E and re-open to traffic.

7. Remove temporary roadways.

SEQUENCE IV - <u>Construct the northbound Central Artery tunnel and other ramps on the northwest side of South Station trackage</u>.

1. Construct a temporary Massachusetts Turnpike Ramp E to the west of its present location and through former Pagoda Park (displaced by the South Station Transportation Project itself), and detour traffic.

2. Construct utility relocations, temporary and permanent for those facilities within the construction area, including Massachusetts Turnpike Pump House 7.

3. Construct Ramp AT-T from Station 23+50± to 25+90± and Ramp AT-CS from Station 22+80± to 25+00±.

4. Construct the northbound Central Artery tunnel from Station 74+00± to Kneeland Street.

5. Construct Ramp T-CN from Station 25+00± to 31+00±.

6. Reconstruct Ramp E to a point 500 feet south of Kneeland Street.

7. Construct a temporary Ramp E along the alignment of Ramp T-CN and meet that section of Ramp E built in Step 6 and detour traffic.

8. Construct a temporary widening of Ramp A-B to the west between the Artery and Ramp C and detour traffic.

9. Construct Ramp AT-CS from Station 20+00± to 22+80±.

10. Construct Vent Buidling "0".

11. Construct Ramp AT-T from Station 22+20± to 23+50±.

12. Begin construction of South Station Ramps (by others).

13. Construct relocation of Massachusetts Turnpike Ramp D to merge with Ramp F and open to traffic.

14. Underpin Central Artery and related roadway structures spanning the Massachusetts Turnpike.

15. Construct the relocation of Massachusetts Turnpike Ramp C.

16. Construct a temporary relocation of Massachusetts Turnpike Ramp A-B to the east, south of Ramp C.

17. Construct Ramp AT-T from Station 10+50± to 22+20±.

18. Construct Ramp A-B and Ramp E in their final alignments and open to traffic.

19. Construct Ramp AT-CS from Station 18+50± to 20+00± and Ramp AT-SR from Station 17+50± to 19+70±.

20. Construct Ramp T-AT from Station 13+00± to 22+10± and Ramp T-CN from Station 21+00± to 25+00±.

2.1.4 Geology and Soils

A review of readily available data was completed for the Atlantic Avenue Tunnel Concept. Principal geotechnical factors affecting the construction were identified, including foundation support for the proposed structures, the methods associated with underpinning adjacent buildings, and lateral support of excavations.

Based on test borings completed for the proposed East Side Interceptor, it appears that foundations for the proposed tunnel structure would bear upon glacial till from Northern Avenue to about Essex Street. From Essex Street to about Thayer Street, the bottom of the tunnel would bear primarily upon other natural inorganic soils, in particular, the marine clay. Locally, the tunnel might bear upon compacted granular fill which would be used to replace unsuitable fill and organic soils.

There are two existing structures which would be directly affected by the proposed construction and would require modification and reconstruction; these are the MBTA Red Line station at South Station, and a below grade portion of the Federal Reserve Bank Building. In addition, 17 other buildings might also be influenced. Underpinning, shoring or other protective measures might be required for these buildings. Studies during project design would be needed to determine specific building protection criteria.

Lateral support systems for excavations required to perform the construction would consist primarily of concrete slurry walls with internal bracing. Steel sheet piling would probably be used at the Red Line South Station crossing and south of Kneeland Street. Limited sections of the proposed alignment appear suitable for external bracing (tie-backs), but additional studies would be needed to confirm this conclusion.

2.1.5 Ventilation

Ventilation requirements for the Atlantic Avenue Tunnel Concept would be essentially the same as those for Alternative 5A. (See the Supportive Engineering Report of the SDEIS/DEIR.) The respective lengths of northbound Central Artery tunnel would be virtually identical. Due to clearance requirements, the position of the ventilation ducts for the northbound Central Artery tunnel would have to switch from the side(s) to top and bottom, to side and bottom, to top and bottom, resulting in a more complex system in the transition areas. More side venting would be required for the ramp tunnels in the South Bay area since vertical clearances would become more critical. The ventilation building in South Bay would be located approximately 500 feet to the west of the location shown for Alternative 5A. (See Chapter 6.0 of the Supportive Engineering Report of the SDEIS/DEIR.)

2.1.6 Power

Power requirements for the Atlantic Avenue Concept would be similar to those for Alternative 5A. (See Chapter 7.0 of the Supportive Engineering Report of the SDEIS/DEIR.)

2.1.7 Project Costs

The total project costs developed for this concept are based on the parameters presented in the Supportive Engineering Reports of the Draft EIS/EIR (December 1982) and Supplemental Draft EIS/EIR (June 1983). Costs developed for this concept are similar to those of Alternative 5A with the exception of the South Bay Area. The Atlantic Avenue alignment of the Central Artery northbound tunnel necessitates different construction techniques, a greater number of underpinned structures, and more utility relocations than those stated for Alternative 5A. The construction costs for the South Bay Area would range from $188 million to $220 million. The total construction cost for this concept would range from approximately $2.227 billion to $2.259 billion. Compared to Alternatives 3A, 5A, and 6, construction of the northbound Central Artery tunnel beneath Atlantic Avenue has a premium of $43 - 75 million attached to it.

2.1.8 Energy

The energy consumption for the Atlantic Avenue Tunnel Concept would be similar to that for Alternative 5A. (See Chapter 10.0 of the Supportive Engineering Report of the SDEIS/DEIR.)

2.1.9 Design Criteria

Design Controls

The major controls governing the horizontal alignment of a northbound Central Artery tunnel are those buildings which front Atlantic Avenue and include the historic Leather District, the Essex Hotel, the Dewey Square Office Tower, the South Station Transportation Center, and the Federal Reserve Bank building. The existing Dewey Square Tunnel also acts as a westerly limit to the horizontal geometry.

The major controls governing the vertical geometry are the South Station trackage, the surface elevation of Atlantic Avenue, and the Red Line tunnel beneath Dewey Square which must be overpassed.

Design Standards

The design standards

established for Alternative 5A in Chapter 11.0 of the Supportive Engineering Report of the SDEIS/DEIR would also apply to the Atlantic Avenue Tunnel Concept, to the extent possible. The major exception to these standards would involve the horizontal curve of the northbound Central Artery tunnel as it would pass beneath Dewey Square. A radius of approximately 1,400 feet would be required as a result of the design controls identified above.

2.2 ENVIRONMENTAL CONSEQUENCES

Environmental consequences of the Atlantic Avenue Tunnel Concept would be similar to those of Alternative 5A, except in the vicinity of Atlantic Avenue and in the Fort Point Channel.

The Atlantic Avenue Tunnel alignment would have serious consequences for the area and for several abutting parcels, including property acquisitions, functional constraints and constraints to development. It would especially have serious consequences on public transportation. Atlantic Avenue would be essentially closed during construction for a period of 2 to 3 years. This would create problems of access to and through the area and traffic congestion on nearby streets.

2.2.1 Transportation

Construction of the Atlantic Avenue Tunnel alignment would require that Atlantic Avenue be closed to vehicular traffic for a period of 2 to 3 years. The loss of this particular major city street would result in a serious disruption of traffic, and would be especially disruptive in combination with closures of other roadways during Central Artery construction, as Atlantic Avenue would be useful as a detour route during Central Artery construction. The overall traffic impacts of Central Artery construction would therefore be exacerbated by this alignment. Traffic from the Massachusetts Turnpike would be forced to use South Street in the Leather District, and severe congestion on that and other local streets would be anticipated.

Serious consequences for mass transit would occur, as the Atlantic Avenue concept would disrupt MBTA Red Line service in the South Station area. The inter-modal transfer functions of the South Station Transportation Center, a major transportation development sponsored by the City, the State and the Federal government, would be seriously constrained by loss of direct connections to MBTA service. Loss of vehicular access from Atlantic Avenue, Dewey Square and Summer Street during construction would also erode the effectiveness of the new facility.

Long-term traffic impacts in this area would be similar to those of Alternative 5A, except that improvements in access from the south would result from construction of the relocated Dorchester Avenue.

2.2.2 Land Use and Economic Impacts

Functional impacts and loss of access to the Leather District would have a dampening effect on building renovations and businesses moving in to this historic district. Some business displacements could be expected due to loss of truck access along Atlantic Avenue.

The construction of the Atlantic Avenue alignment would delay and might constrain development in the South Station area, such as the future air-rights development of the land leased by Wang. Loss of vehicular access from Atlantic Avenue would also affect office, residential and hotel use in the area, including Russia Wharf, Dewey Square, Harbor Plaza and the Essex Hotel.

2.2.3 Neighborhood and Community Facilities Impacts

Access to South Boston would be constrained by the closure of Atlantic Avenue, Summer Street, and Congress Street during construction of this

alignment. All other effects to neighborhood and community facilities would be similar to Alternative 5A.

2.2.4 Air Quality

Long-term air quality impacts would be comparable to those of Alternative 5A. The location of ventilation buildings would be the same or similar under either alternative. During construction, air quality in the Dewey Square area could degrade further as a result of increased traffic congestion.

2.2.5 Noise and Vibration

Noise and vibration impacts during construction in the Fort Point Channel would be somewhat less for the Atlantic Avenue Tunnel Concept than for Alternative 5A since the pile-supported northbound Central Artery tunnel of Alternative 5A would be removed from the Channel, and only pile supports for new Dorchester Avenue will be required. Conversely, noise and vibration impacts due to construction in Atlantic Avenue would be significantly greater for the Atlantic Avenue Tunnel Concept than for Alternative 5A, since only surface street construction in Atlantic Avenue would be required with Alternative 5A. Noise and vibration impacts in Atlantic Avenue under the Atlantic Avenue Tunnel Concept would be those associated with the construction of slurry walls rather than those associated with pile driving, which would probably not be required.

2.2.6 Water Resources

In the Fort Point Channel the Atlantic Avenue alignment necessitates utility relocations and the construction of Dorchester Avenue on piles, as in Alternative 5A Modified (the Preferred Alternative), but not tunnel construction. Some adverse short-term effects would be possible during construction, but would be less than for Alternative 5A Modified. Long-term effects of the Atlantic Avenue alignment could be less than those of Alternative 5A Modified, as less water would be displaced by a pile-supported Dorchester Avenue than by a combination of the tunnel and related Dorchester Avenue structures of Alternative 5A Modified. However, the 96-inch East Side Interceptor sewer would be placed in the Fort point Channel as a result of the Atlantic Avenue Tunnel alignment, and this would displace some water volume; the net effect on water volume in the Fort Point Channel would be a reduction from existing conditions.

2.2.7 Section 4(f) Impacts

The Atlantic Avenue Tunnel alignment would entail Section 4(f) impacts in the Fort Point Channel historic district, but these are slightly less than the impacts of Alternative 5A Modified. The Old Colony Railroad Bridge, an historic structure, would be removed with both the Atlantic Avenue Tunnel alignment and Alternative 5A Modified. The Atlantic Avenue Tunnel alignment could have impacts, including potential structural damage from vibration and other sources during construction, on the historic Leather District and on the South Station headhouse. Alternative 5A Modified will not affect these historic districts and structures.

3.0 DORCHESTER AVENUE CONCEPT

3.1 ENGINEERING DESCRIPTION

This concept places the northbound Central Artery tunnel beneath the present location of Dorchester Avenue. The tunnel box would be constructed adjacent to the existing bulkhead line of the Fort Point Channel but would not be in the Channel itself. Dorchester Avenue would be reconstructed above the tunnel box with two northbound lanes open to the public. Except for the location of this portion of the Central Artery northbound alignment, most aspects of the design of this concept would be similar to Alternative 5A Modified, with the exception of stage constructon. The tunnel would be constructed in short

sections in order to allow some South Postal Annex truck bays to remain open at all times during construction.

3.2 ENVIRONMENTAL CONSEQUENCES

3.2.1 Transportation

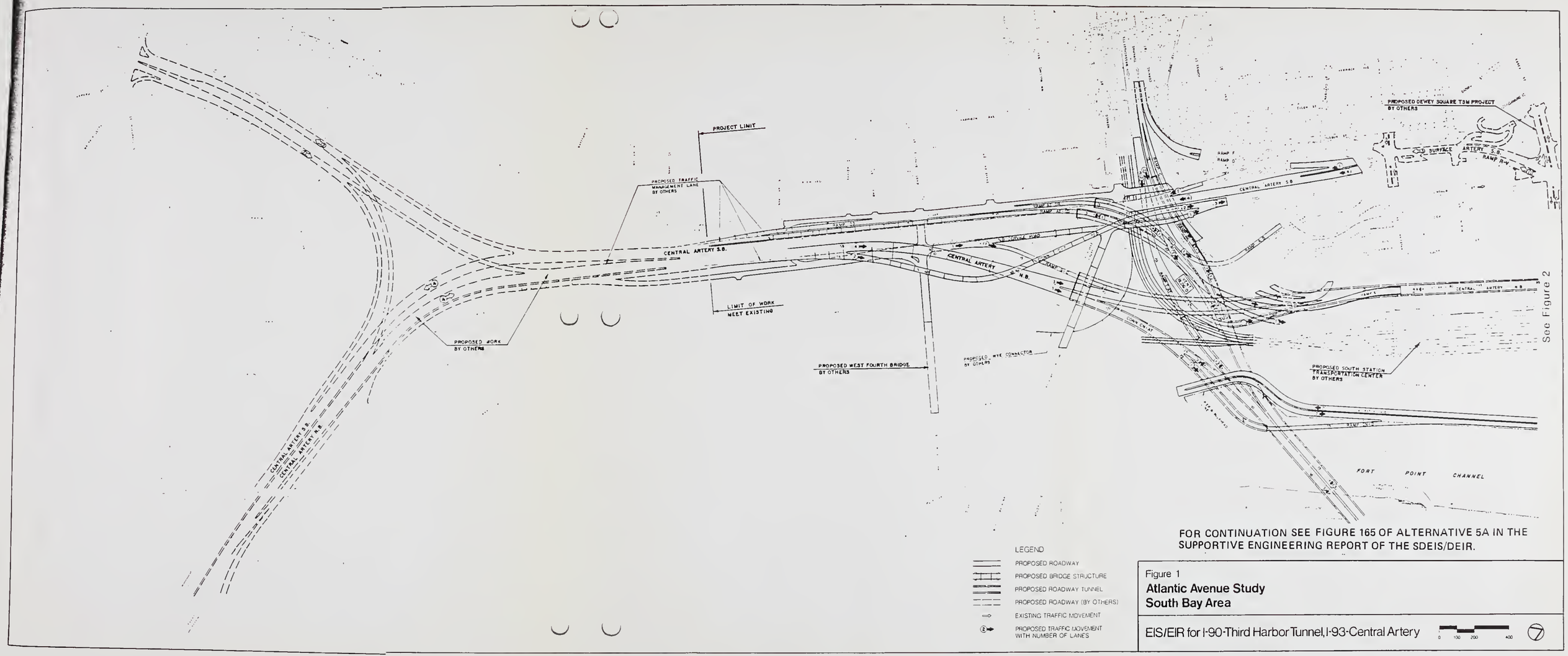
The vertical geometry of this tunnel alignment would require further speed reduction on the Service Road to Central Artery northbound ramp and the Central Artery northbound, by 10 to 17 miles per hour. These reductions are within acceptable limits. All other transportation impacts would be similar to those of Alternative 5A Modified.

3.2.2 Right-of-Way Impacts

Construction of a tunnel box next to the Fort Point Channel bulkhead line would require the removal of the bridge abutments at Summer and Congress Streets. These would have to be rebuilt after the tunnel structure is complete. The existing pier and bulkhead line of the Channel would also have to be removed and be rebuilt since the easterly wall of the tunnel would be approximately at the existing pier and bulkhead line.

Primary impacts of this tunnel alignment are to the South Postal Annex. During construction, the bays used by trucks would be disrupted. All of the bays would be affected at different times during construction. The foundations of the South Postal Annex may be affected by construction since the tunnel would be between 15 feet and 30 feet from the face of the building.

Long-term impacts to the Postal Annex operations would result from the permanent loss of truck maneuvering space; the South Postal Annex could not continue its operations under those circumstances as discussed by the Postal Service during the EIS/EIR preparation. This concept would therefore require the relocation of the South Postal Annex in accordance with federal requirements. Because of the magnitude of this relocation, the Dorchester Avenue Concept has been deemed not feasible or prudent.



FOR CONTINUATION SEE FIGURE 165 OF ALTERNATIVE 5A IN THE SUPPORTIVE ENGINEERING REPORT OF THE SDEIS/DEIR.

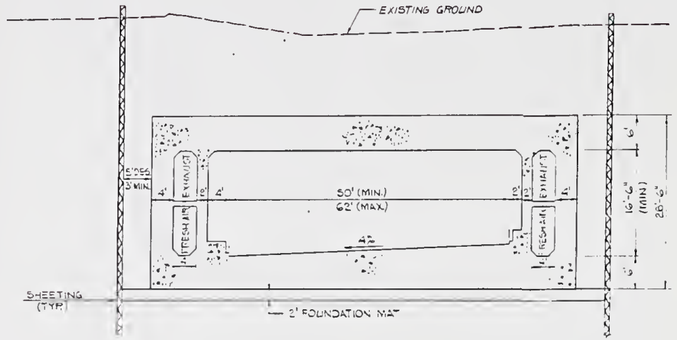
Figure 1
Atlantic Avenue Study
South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

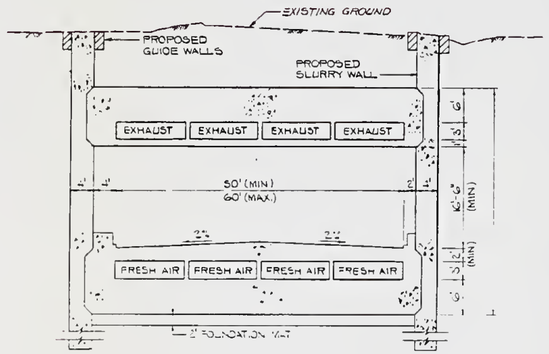
Figure 2
Atlantic Avenue Study
Central Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 100 200 400

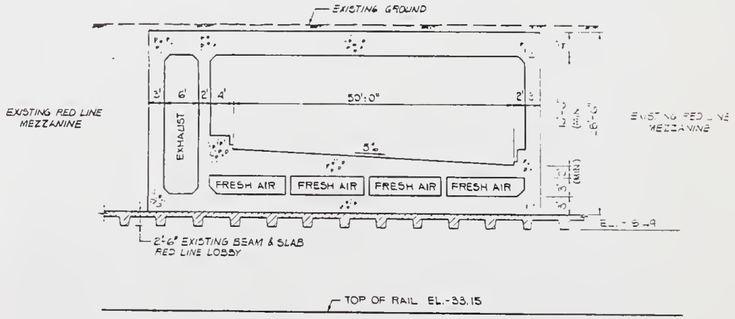


Central Artery Northbound
Sta 68+25 – Sta. 77+50

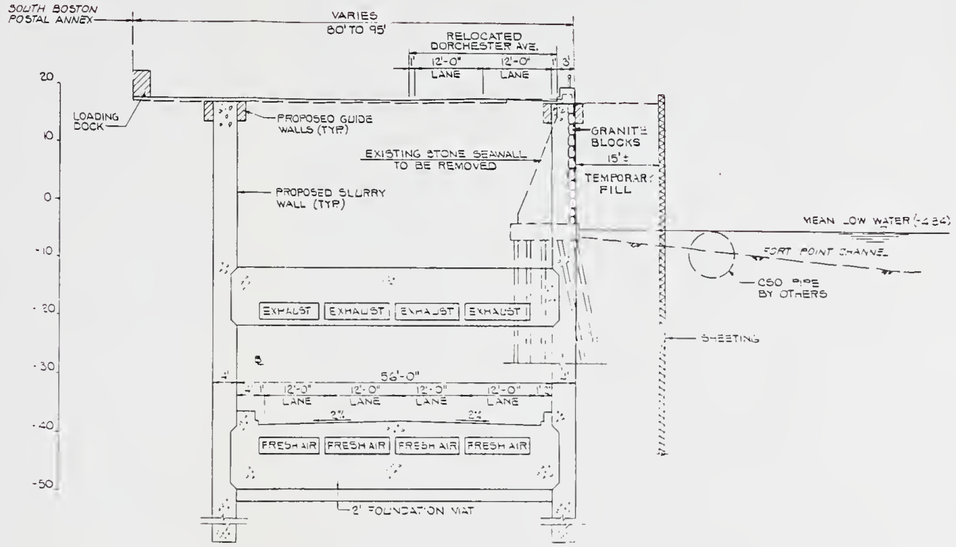


Central Artery Northbound
Sta. 77+50 – Sta. 93+30
Sta. 104+50 – Sta. 115+00

ATLANTIC AVENUE CONCEPT



Central Artery Northbound
Red Line Crossing At Dewey Square
Sta. 93+30 – Sta. 104+50



Central Artery Northbound
Sta. 94+50

DORCHESTER AVENUE CONCEPT

Figure 3
Atlantic Avenue/Dorchester Avenue Concepts – Typical Sections
South Bay Area

EIS/EIR for I-90-Third Harbor Tunnel, I-93-Central Artery

0 5 10 20 Feet

APPENDICES

APPENDIX 1:
AIR QUALITY

LIST OF TABLES

Table No.	Description	Page
1	Traffic Volumes for the No-Build Alternative	10
2	Traffic Volumes for the Two-Way Tunnel Concept	21
3	Traffic Input Data for the Intersection at Leverett Circle for the 1 Hour	35
4	Traffic Input Data for the Intersection at Leverett Circle for the 8 Hour	36
5	Traffic Input Data for the Intersection at Bell Circle for the 1 Hour	37
6	Traffic Input Data for the Intersection at Bell Circle for the 8 Hour	38
7	Traffic Input Data for the Intersection at Kneeland Street and X-Way Off Ramp for the 1 Hour	39
8	Traffic Input Data for the Intersection at Kneeland Street and X-Way Off Ramp for the 8 Hour	40
9	Traffic Input Data for the Intersection at Kneeland Street, Surface Artery Road, and X-Way Off Ramp for the 1 Hour	41
10	Traffic Input Data for the Intersection at Kneeland Street, Surface Artery Road, and X-Way On Ramp for the 8 Hour	42
11	Traffic Input Data for the Intersection at Atlantic Avenue and Summer Street for the 1 Hour	43
12	Traffic Input Data for the Intersection at Atlantic Avenue and Summer Street for the 8 Hour	44
13	Traffic Input Data for the Intersection at Atlantic Avenue and Congress Street for the 1 Hour	45
14	Traffic Input Data for the Intersection at Atlantic Avenue and Congress Street for the 8 Hour	46
15	Traffic Input Data for the Intersection at Atlantic Avenue and Northern Avenue/Oliver Street for the 1 Hour	47
16	Traffic Input Data for the Intersection at Atlantic Avenue and Northern Avenue/Oliver Street for the 8 Hour	48

TABLE OF CONTENTS

		Page
1.1	Air Quality Analysis Methods and Input Data	1
1.2	Estimating Emissions from Motor Vehicle Sources	1
1.3	Emissions, Ventilation Requirements, and Concentrations in the Tunnels	7
1.4	Diffusion Modeling Analysis	7

LIST OF FIGURES

Figure No.	Description	Page
1	Road Network for Downtown Boston	-
2	Detail of Massachusetts Turnpike/Central Artery/Proposed Tunnel/South Station Interchange	3
3	Road Network for South Boston	4
4	Detail of Proposed Tunnel Corridor in South Boston	5
5	Road Network for East Boston	[illegible]

LIST OF TABLES (CONT'D.)

Table No.	Description	Page
32	Traffic Input Data for the Intersection at Congress Street and West Tunnel Ramps for the 8 Hour	64
33	Traffic Input Data for the Intersection at Summer Street and Tunnel Ramps for the 1 Hour	65
34	Traffic Input Data for the Intersection at Summer Street and Tunnel Ramps for the 8 Hour	66
35	Traffic Input Data for the Intersection at Northern Avenue and East Tunnel Ramps for the 1 Hour	67
36	Traffic Input Data for the Intersection at Northern Avenue and East Tunnel Ramps for the 8 Hour	68
37	Traffic Input Data for the Intersection at Congress Street and Seaport Access Road for the 1 Hour	69
38	Traffic Input Data for the Intersection at Congress Street and Seaport Access Road for the 8 Hour	70
39	Traffic Input Data for the Intersection at N. Washington St./New Chardon/Cross St. for the 1 Hour	71
40	Traffic Input Data for the Intersection at N. Washington St./New Chardon/Cross St. for the 8 Hour	72
41	Traffic Input Data for the Intersection at N. Washington St./S-B Connector/Cross St./New Chardon St. for the 1 Hour	73
42	Traffic Input Data for the Intersection at N. Washington St./S-B Connector/Cross St./New Chardon St. for the 8 Hour	74
43	Traffic Input Data for the Sumner Tunnel Toll Booths ..	75
44	Traffic Input Data for Callahan Tunnel Entrance	76
45	Traffic Input Data for Callahan Tunnel Toll Booths	77
46	Traffic Input Data for Proposed Tunnel Toll Booths Northbound	78
47	Traffic Input Data for Proposed Tunnel Toll Booths Southbound	79
48	Average Route Speed by Facility Type and Geographic Area for Peak Hour	80

LIST OF TABLES (CONT'D.)

Table No.	Description	Page
17	Traffic Input Data for the Intersection at N. Washington Street and Commercial Street for the 1 Hour	49
18	Traffic Input Data for the Intersection at N. Washington Street and Commercial Street for the 8 Hour	50
19	Traffic Input Data for the Intersection at City Square (Charlestown) for the 1 Hour	51
20	Traffic Input Data for the Intersection at City Square (Charlestown) for the 8 Hour	52
21	Traffic Input Data for the Intersection at City Square (Charlestown) N. Washington/Rutherford Ave./Chelsea/ X-Way Off Ramp for the 1 Hour	53
22	Traffic Input Data for the Intersection at City Square (Charlestown) N. Washington/Rutherford Ave./Chelsea/X-Way Off Ramp for the 8 Hour	54
23	Traffic Input Data for the Intersection at Causeway St./ New Artery S-B Off Ramp/S-B Connector for the 1 Hour ..	55
24	Traffic Input Data for the Intersection at Causeway St./ New Artery S-B Off Ramp/S-B Connector for the 8 Hour	56
25	Traffic Input Data for the Intersection at Causeway St./New Artery N-B Off Ramp/N-B Connector for the 1 Hour	57
26	Traffic Input Data for the Intersection at Causeway St./ New Artery N-B On Ramp/N-B Connector for the 8 Hour ...	58
27	Traffic Input Data for the Intersection at Atlantic Ave./Surface Artery/State St. for the 1 Hour	59
28	Traffic Input Data for the Intersection at Atlantic Ave./ Surface Artery/State St. for the 8 Hour	60
29	Traffic Input Data for the Intersection at Atlantic Ave./Surface Artery/State St. for the 1 Hour	61
30	Traffic Input Data for the Intersection at Atlantic Ave./Surface Artery/State St. for the 8 Hour	62
31	Traffic Input Data for the Intersection at Congress St. and West Tunnel Ramps for the 1 Hour	63

LIST OF TABLES (CONT'D.)

Table No.	Description	Page
49	Average Route Speed by Facility Type and Geographic Area for 8- and 24-Hour	81
50	Existing Tunnels - Input Parameters	82
51	Tunnel Segment Input Parameters for Proposed Tunnel ...	83
52	Exhaust Vents Emission Characteristics	89
53	Source Input Data for ISC Model for the Two-Lane Tunnel Concept in 1990	90

1.1 AIR QUALITY ANALYSIS METHODS AND INPUT DATA

The air quality analysis of the Central Artery Depression/Third Harbor Tunnel project consisted of the estimation of carbon monoxide (CO), oxides of nitrogen (NO_x), and nonmethane hydrocarbons (NMHC) emissions from all motor vehicles in a traffic-affected area that includes most of downtown Boston, East Boston, and South Boston. From these emissions, an estimation was made of the maximum one-hour and eight-hour CO and one-hour nitrogen dioxide (NO_2) concentrations from motor vehicle sources for baseline conditions (1982) and for the No-Build Alternative and the Two-Lane Tunnel Concept for the years 1990 and 2010. This technical appendix does not contain the results of the air quality analysis; rather, it details the modeling procedures and the input data that were used to arrive at the results.

1.2 ESTIMATING EMISSIONS FROM MOTOR VEHICLE SOURCES

Massachusetts vehicle registration data for the light-duty vehicle class (comprising all of the private passenger automobiles), were used. These data were provided by the Commonwealth of Massachusetts Department of Environmental Quality Engineering (DEQE) and appear in Table 1 of the DEIS/DEIR Appendix 5 along with national registration data for the other vehicle classes.

Distribution of Vehicle-Miles-Traveled (VMT) According to Vehicle Category

The regional distribution of VMT was used to develop a composite emission factor and was agreed upon on consultation with DEQE. It is explained in Section 1.1 of the DEIS/DEIR Appendix 5.

Mix of Cold, Stabilized, and Hot Transient Operations

Automobile exhaust emission rates are influenced by the temperature (or operating phase) of the engine. The percentages of travel by operating phase were agreed upon in consultation with DEQE and are given in Section 1.1 of the DEIS/DEIR Appendix 5.

Ambient Temperature

Emission rates of CO decrease with increasing ambient temperatures. In estimating CO emissions, an ambient temperature of 30°F was assumed. For NO_x and NMHC, a temperature of 75°F was used. These temperatures were agreed upon on consultation with DEQE.

Traffic Volume Data

Traffic volumes are used along with emission factors to obtain emission rates. Traffic volume data were developed by the Central Transportation Planning Staff, HFMW and Vanasse-Hangen Design, Inc. [2] in a number of formats depending on end use. The formats include traffic on local streets, the expressways, the tunnels, and a number of selected intersections.

Figure 1 shows the various roadway links and their identification codes that were used in describing the traffic volumes for downtown Boston. Similar schematics are shown for South Boston in Figures 2, 3 and 4 and East Boston in Figure 5. Table 1 shows the 1-hour, 8-hour and 24-hour traffic volumes for the various road links for the existing (1982) condition, and the No-Build Alternative in 1990 and 2010. Roadway links in downtown Boston, East Boston, and South Boston are all included in this table. Similar data for the Two-Lane Tunnel Concept for 1990 and 2010 are presented in Table 2. More detailed description of the traffic data used and the estimation procedures are given in Appendix 4 - Traffic of the DEIS/DEIR.

In addition to the free flow traffic, a detailed analysis of a number of potential traffic congestion locations in the study area was made for all alternatives. These locations

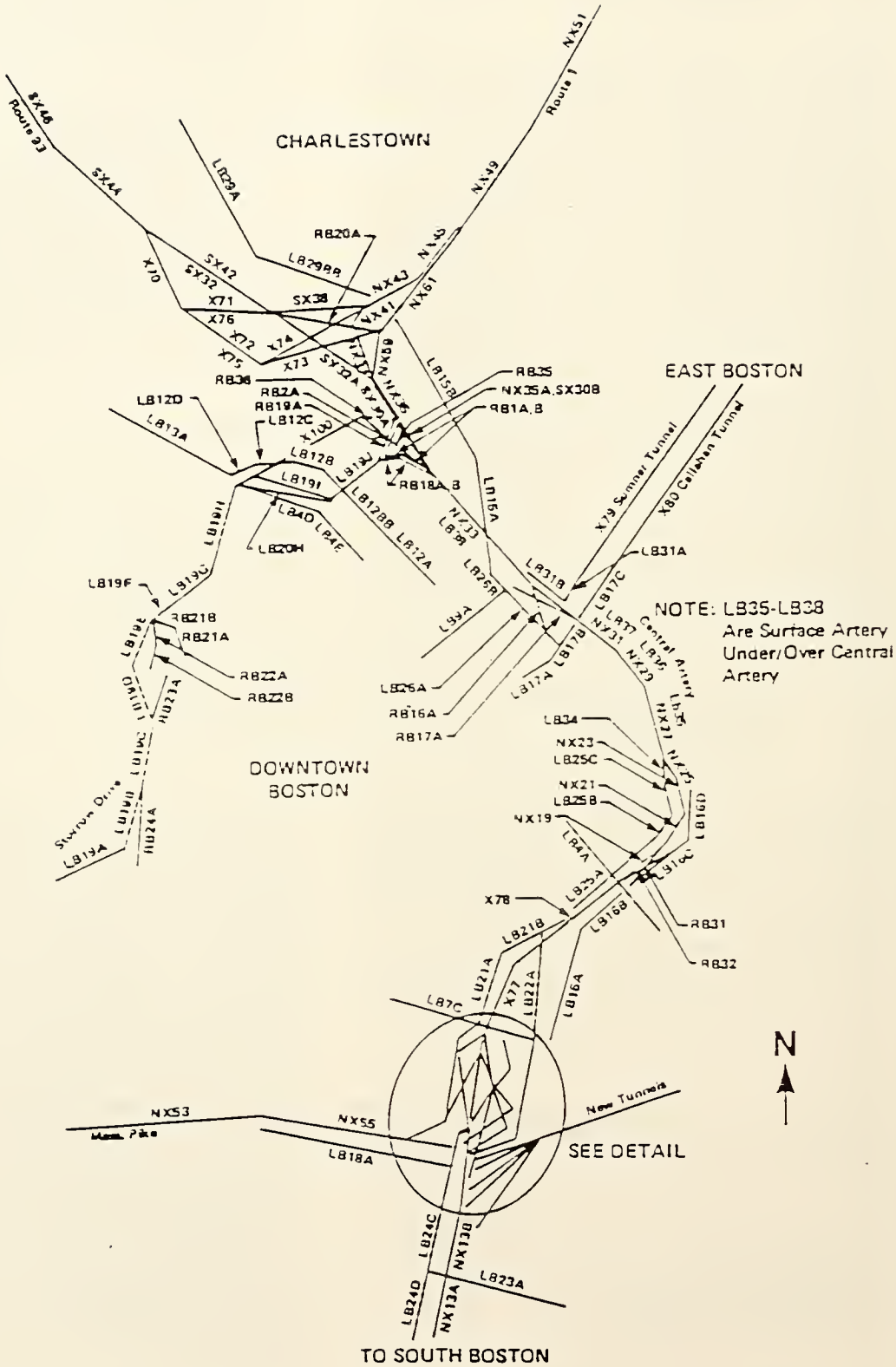


Figure 1

Road Network for Downtown Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

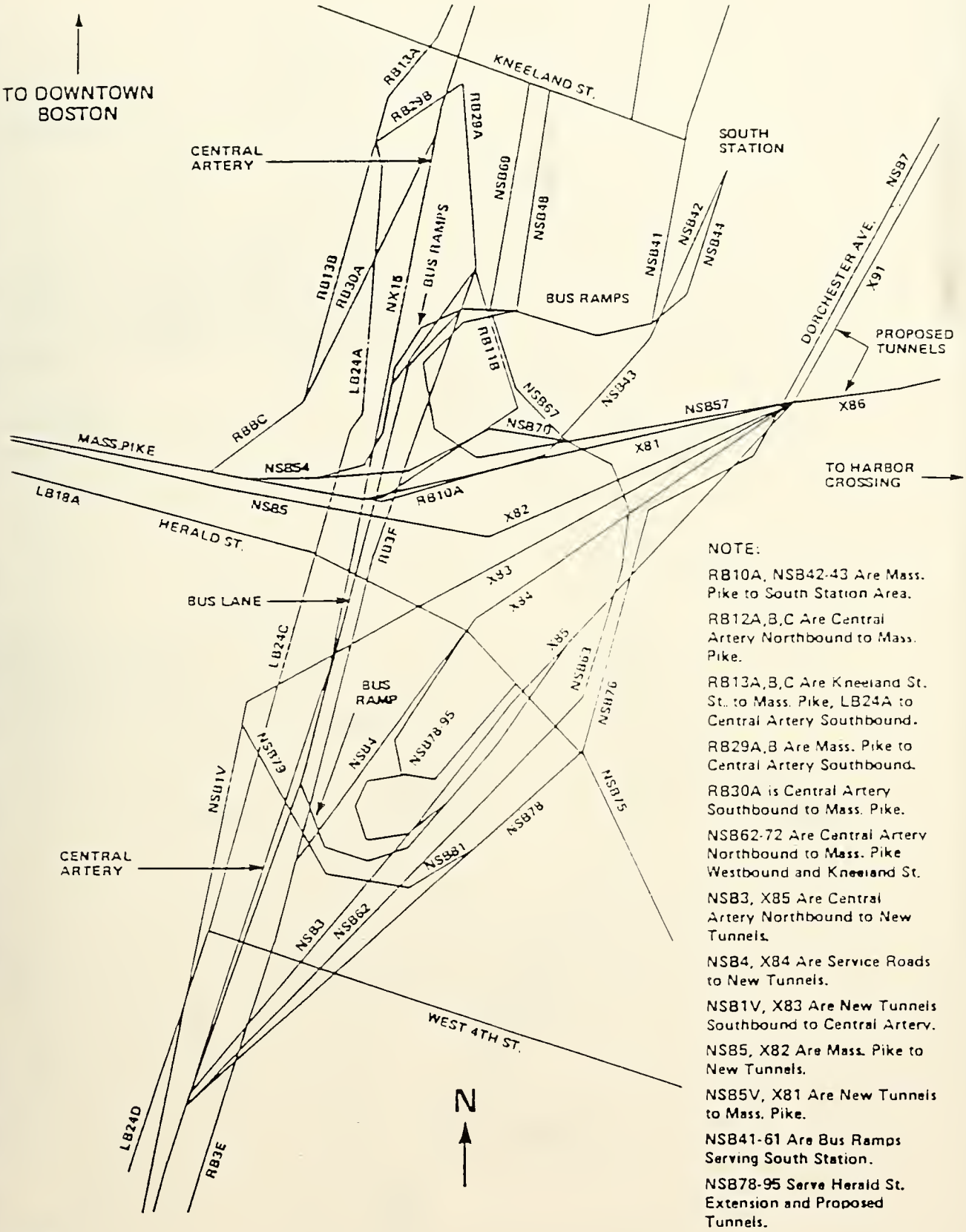


Figure 2

Detail of Massachusetts Turnpike / Central Artery / Proposed Tunnel / South Station Interchange, as Used in the Air Quality Modeling Analysis

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

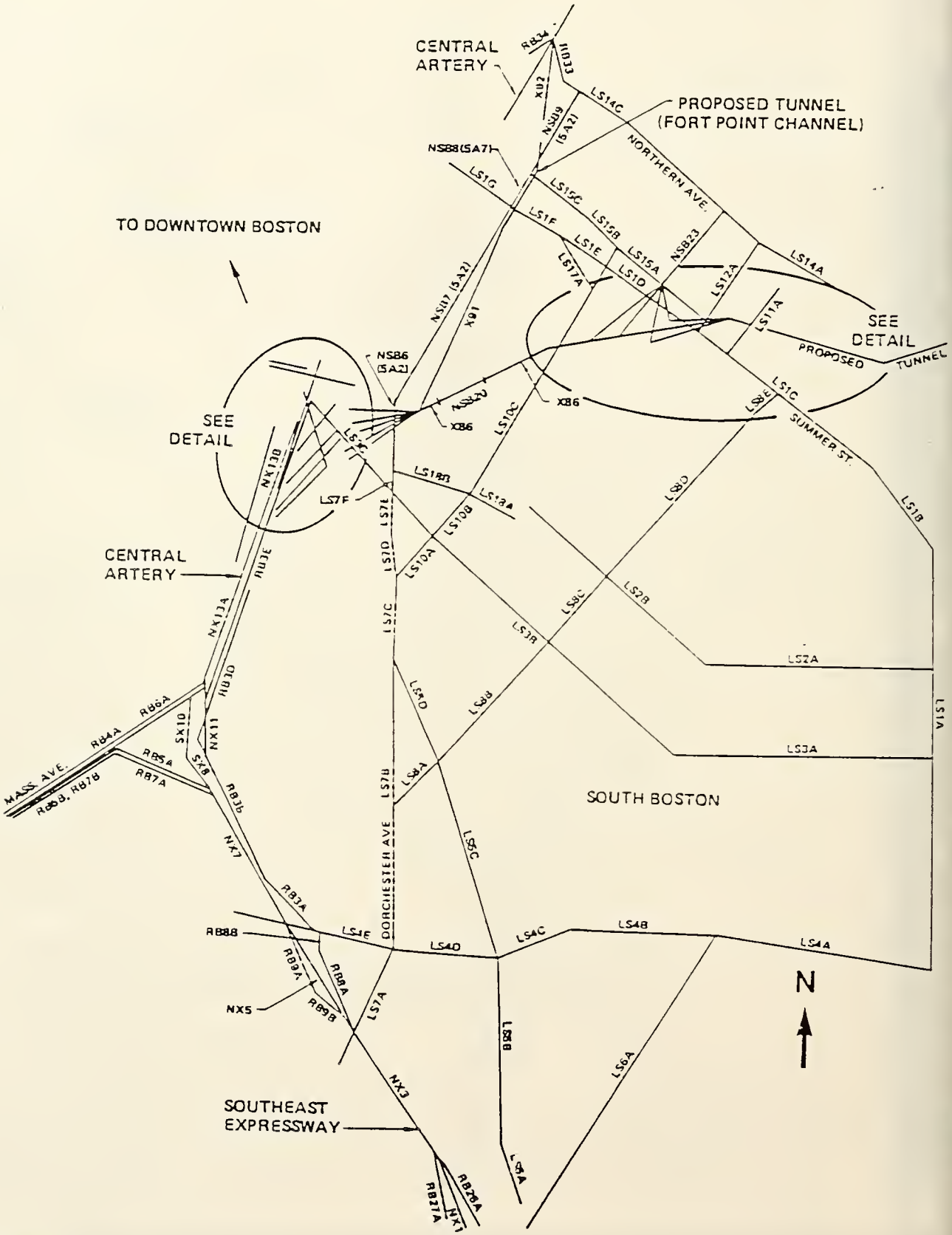


Figure 3

Road Network for South Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

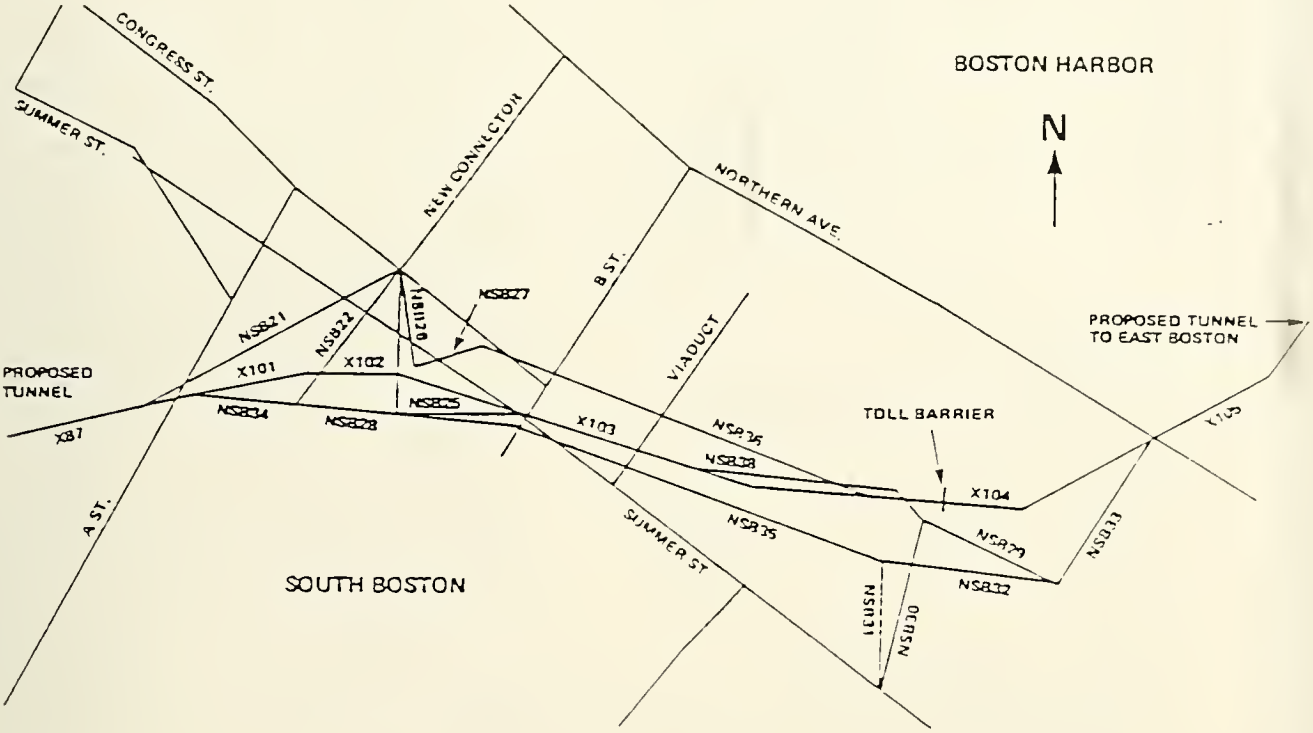


Figure 4 -

Detail of Proposed Tunnel Corridor in South Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for I-90 – Third Harbor Tunnel, I-93 – Central Artery

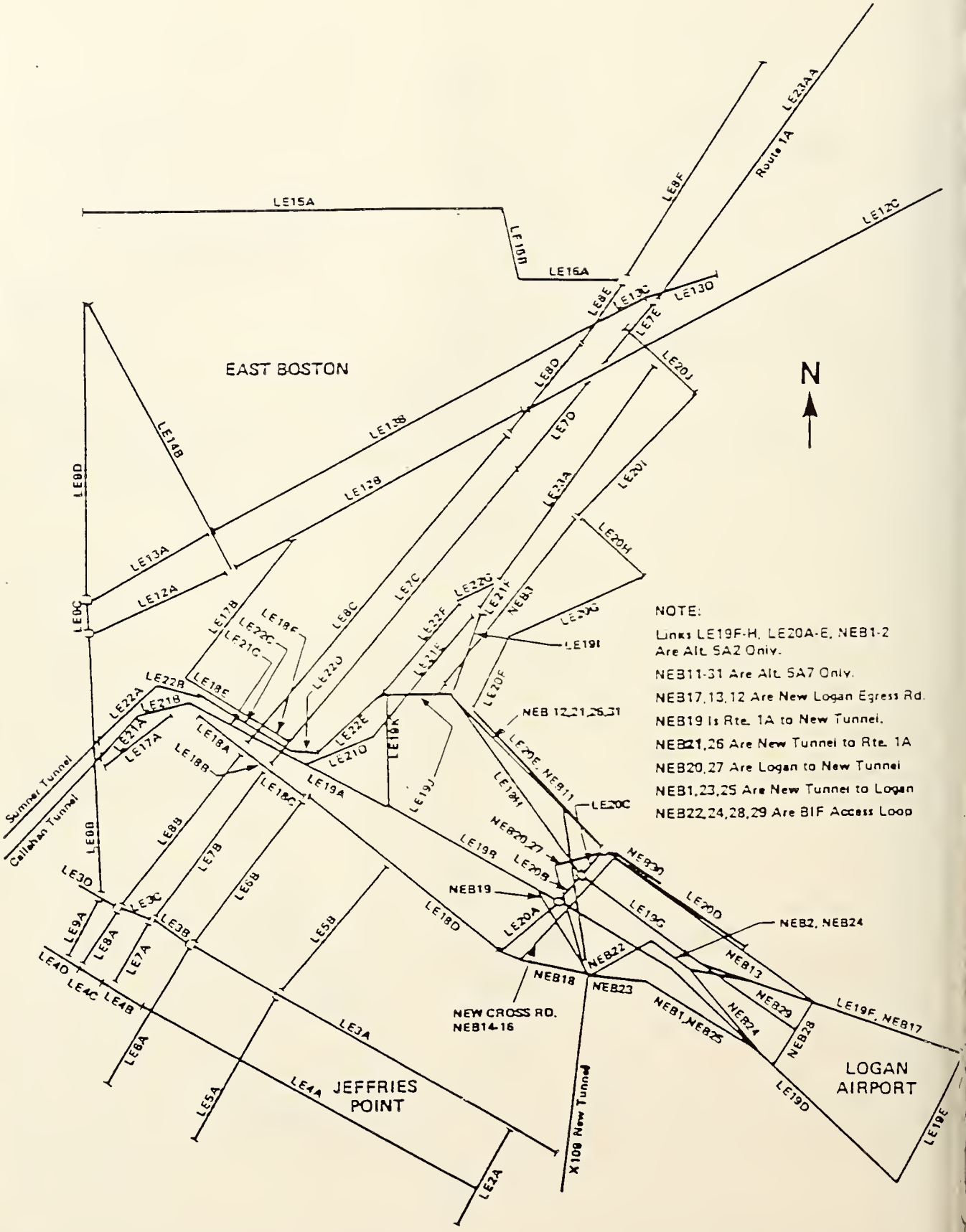


Figure 5

Road Network for East Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

include the 14 intersections analyzed previously, the Callahan Tunnel entrance, the existing Sumner and Callahan toll plazas, and the toll plazas associated with the proposed tunnel. In addition, two more intersections were analyzed for the Two-Lane Tunnel Concept. These intersections were chosen because the project is expected to have significant traffic effects at these locations. To ensure consistency among all alternatives, these intersections were also analyzed for the No-Build Alternative. The two additional intersections are Summer Street/Tunnel Ramps and Northern Avenue/East Tunnel Ramps. Tables 3 through 42 show the one-hour and average eight-hour demand volumes, approach capacities, signal cycle times, green phase times, and the number of lanes per approach for each intersection for all project alternatives. Demand volumes, queue lengths, and wait times for toll plazas are shown in Tables 43 through 47.

Vehicle Speeds

Emission factors vary with average vehicle speed. The average vehicle (free flow) speeds that were used in the analysis were supplied by HFMW. They vary with the average time periods, the type of facility, and the location. For each facility, 1-hour, 8-hour, and 24-hour speeds were estimated as shown in Tables 48 and 49.

Credit for Inspection and Maintenance

Following consultation with EPA and DEQE, it was decided that modeling analysis for the Third Harbor Project would be based on no I/M credit. The effects of I/M on emissions are discussed in Part I of the DEIS/DEIR Appendix 5, Section 1.1.

1.3 EMISSIONS, VENTILATION REQUIREMENTS, AND CONCENTRATIONS IN THE TUNNELS

The emission rates in the various tunnel segments were estimated according to a procedure given in the DEIS/DEIR Appendix 5, Section 1.2. The demand traffic volumes, the tunnel segment lengths, and the average vehicle speed in the existing tunnels for all project alternatives are given in Table 50. Similar data are given in Table 51 for the proposed tunnel. Emission characteristics are shown in Table 52.

Ventilation Requirements

For the existing Sumner, Callahan, and Dewey Square Tunnels, the Massachusetts Turnpike Authority and the Massachusetts Department of Public Works provided ventilation fan capacity data [3,4] for the analysis. The capacities for the individual ventilation buidings are given in Table 35 of the DEIS/DEIR Appendix 5.

For the proposed tunnel, the ventilation requirement is based on the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE's) criterion of 155 liters per meter per lane per second.

Pollutant Concentrations

The average concentration of CO and NO_2 in a given tunnel segment was estimated according to the procedure given in the DEIS/DEIR Appendix 5, Section 1.2.

1.4 DIFFUSION MODELING ANALYSIS

After the pollutants are discharged into the atmosphere by the various emission sources, the pollutants are transported by the prevailing wind and diluted through dispersion by atmospheric turbulence. The resulting pollutant concentration at any location in the study area is dictated by the rate of emission of the pollutant sources, the spatial distribution of the emission sources, and the meteorology variables.

Estimating Pollutant Concentrations from Motor Vehicle Sources

Ambient CO concentrations caused by motor vehicles on the

expressways, arteries, local streets, and toll plazas were estimated by the Federal Highway Administration's CALINE 3 Model [5]. For the vent building analysis, EPA's ISC Model [6] was used. Input data are shown in Table 54 for the 1990 Two-Lane Tunnel Concept example. The various input elements to the modeling analysis are described in the DEIS/DEIR Appendix 5, Section 1.3.

Emission Rates

Emission rates for automotive sources are specified as emissions of CO per unit time per unit length of roadway. These emission rates are estimated according to EPA's indirect source guidelines [7] and are described in the DEIS/DEIR Appendix 5, Section 1.3.

Spatial Distribution of Emission Sources and Receptor Locations

Because of the extent of the project area, many receptors were selected from Downtown Boston, East Boston, South Boston, and Revere. These receptors represent areas that the public has access to over time periods that correspond to the applicable air quality standards. The receptors shown in Figure 6 include recreational facilities (e.g., Rotch Playground and Porzio Park), residences (e.g., Heritage Apartments in East Boston, and Bell Circle residences), and areas with high public access (e.g., Quincy Market and Atlantic Avenue by the Federal Reserve Bank).

Meteorological Variables

The primary variables affecting the dispersion of pollutants are wind speed and direction, atmospheric stability, and the vertical thickness of the mixing layer. These are described in more detail in the DEIS/DEIR Appendix 5, Section 1.3.

Background CO Concentrations

The background concentration is the level resulting from the sources other than the immediate adjacent streets, expressways, toll plazas, and ventilation building that were considered directly in the modeling analysis. Consistent with the modeling assumptions used in the DEIS/DEIR, a one-hour CO background of 4.4 parts per million (ppm) was assumed for 1980. The rollback technique was used to arrive at a 4.0 ppm background for 1982, 2.1 ppm for 1990, and 1.6 ppm for 2010. Eight-hour background levels were established by applying a 0.8 persistence factor to the background levels described above, as agreed upon in consultation with the EPA.

Estimating NO_2 Concentrations from the Vent Buildings

Maximum one-hour NO_2 concentrations were estimated by two separate procedures: 1) using EPA's ISC model for the basic set of receptors that are located typically more than 100 meters away from the nearest vent; and 2) using Halitsky's "near-field" model [8] for receptors at building air-intakes or pedestrian sidewalk levels that are located less than or equal to 100 meters from the vent. These procedures are explained in the DEIS/DEIR Appendix 5, Section 1.3 and the SDEIS/SDEIR Appendix 5, Section 1.3.

Background NO_2 Concentrations

Following discussions with DEQE, the 1-hr. NO_2 background concentrations that are used in the impact assessment are 170 ug/m^3 for sites in East Boston, and 224 ug/m^3 for all other sites.

REFERENCES

1. "User's Guide to MOBILE 2," U.S. Environmental Protection Agency, Office of Mobile Source Air Pollution Control, Report No. EPA-460/3-81-006, Ann Arbor, MI, February 1981.

2. HFMW, Waltham, MA, Personal communications, July, August and September 1983.

3. Massachusetts Turnpike Authority, Boston, MA, Personal communications, September 1982.

4. Massachusetts Department of Public Works, Boston, MA, Personal communications, September 1982.

5. "CALINE 3 - A Versatile Dispersion Model for Predicting Air Pollutant Levels Near Highways and Arterial Streets," California Department of Transportation, Report No. FHWA/CA/TL-79/23, November 1979.

6. "Industrial Source Complex (ISC) Disperson Model User's Guide," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Report No. EPA-450/4-79-030, Research Triangle Park, NC December 1979.

7. "Guidelines for Air Quality Maintenance Planning and Analysis, Volume 9 (Revised): Evaluating Indirect Sources," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1978.

8. Halitsky, James, "Gas Diffusion Near Buildings," Chap. 5-5, Meteorology and Atomic Energy, U.S. Atomic Energy Commission, Office of Information Services, Silver Springs, MD, July 1968.

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NX1	8198.	64042.	133420.	11766.	80640.	168000.	12691.	82032.	170900.	XWAY 2WAY
NX3	9700.	77904.	162300.	14319.	80640.	168000.	15355.	82032.	170900.	XWAY 2WAY
NX5	9550.	70968.	147850.	14222.	80352.	167400.	16243.	81456.	169700.	XWAY 2WAY
NX7	10350.	78312.	163150.	15355.	78144.	162800.	16983.	79392.	165400.	XWAY NB
NX11	2500.	27456.	57200.	4255.	31488.	65600.	4847.	31824.	66300.	XWAY NB
NX13A	8450.	73776.	153700.	13320.	80256.	167200.	14245.	81312.	169400.	XWAY 2WAY
NX13B	6553.	66288.	138100.	6068.	74688.	155600.	7067.	76272.	158900.	XWAY 2WAY
NX15	5189.	53280.	111000.	9546.	57552.	119900.	10027.	59088.	123100.	XWAY NB
NX19	6532.	69024.	143800.	9472.	66816.	139200.	11137.	68496.	142700.	XWAY NB
NX21	6262.	69720.	145250.	9398.	72576.	151200.	9871.	74880.	156000.	XWAY NB
NX23	6262.	69720.	145250.	9398.	72576.	151200.	9871.	74880.	156000.	XWAY NB
NX25	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX27	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX29	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX31	8042.	77616.	161700.	10656.	80400.	167500.	11248.	83088.	173100.	XWAY NB
NX33	8042.	77616.	161700.	10656.	80400.	167500.	11248.	83088.	173100.	XWAY 2WAY
NX35	5347.	34008.	70850.	4625.	32496.	67700.	4403.	34080.	71000.	1WAY NB
NX35A	3347.	22680.	47250.	4773.	26400.	55000.	4662.	27216.	56700.	1WAY NB
NX37	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX41	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX43	2180.	17088.	35600.	0.	0.	0.	0.	0.	0.	1WAY
NX45	2180.	17088.	35600.	0.	0.	0.	0.	0.	0.	1WAY SB
NX49	5295.	34800.	72500.	5624.	35424.	73800.	6068.	37968.	79100.	XWAY 2WAY
NX51	5295.	34800.	72500.	5624.	35424.	73800.	6068.	37968.	79100.	XWAY 2WAY
NX53	5260.	34176.	71200.	5920.	38208.	79600.	6586.	38400.	80000.	MASS PIKE
NX55	5260.	34176.	71200.	5920.	38208.	79600.	6586.	38400.	80000.	MASS PIKE
NX59	1953.	14712.	30650.	0.	0.	0.	0.	0.	0.	CITY SQ
NX61	3115.	17712.	36900.	5624.	35424.	73800.	6068.	37968.	79100.	CITY SQ
SX8	5250.	38736.	80700.	8288.	39888.	83100.	8621.	40560.	84500.	1WAY SB
SX10	5250.	38736.	80700.	8288.	39888.	83100.	8621.	40560.	84500.	1WAY SB
SX30A	3710.	34200.	71250.	4023.	38688.	80600.	3996.	39744.	82800.	1WAY SB
SX30B	1890.	23544.	49050.	3034.	24192.	50400.	3034.	25776.	53700.	1WAY SB
SX32	2150.	21768.	45350.	2849.	24768.	51600.	2997.	26160.	54500.	93
SX32A	5354.	39240.	81750.	8659.	38688.	80600.	8399.	39744.	82800.	93

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
SX38	895.	1872.	3900.	0.	0.	0.	0.	0.	0.	93
SX42	4289.	21168.	44100.	4292.	24288.	50600.	4403.	24720.	51500.	93
SX44	6439.	42936.	89450.	7141.	49056.	102200.	7400.	50880.	106000.	93
SX46	6439.	42936.	89450.	7141.	49056.	102200.	7400.	50880.	106000.	93
NX70	0.	71520.	149000.	740.	5088.	10600.	851.	4800.	10000.	93 OFF SB -US1NB
NX71	0.	0.	0.	1739.	13680.	28500.	1628.	14928.	31100.	93 OFF NB TO US1NB
NX72	0.	0.	0.	2516.	18720.	39000.	2479.	19728.	41100.	93 CONNECT 93S-US1N
NX73	0.	0.	0.	2516.	18720.	39000.	2479.	19728.	41100.	ON TO US1 NB
NX74	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	OFF US1 SB TO 93SB
NX75	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	CONNECT US1SB-93NB
NX76	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	ON TO 93SB
X77	5189.	53280.	111000.	0.	57552.	119900.	0.	59088.	123100.	DEWEY SQ TUNNEL
X78	6532.	69024.	143800.	0.	66816.	139200.	0.	68496.	142700.	DEWEY SQ TUNNEL
X79	2639.	22100.	42500.	0.	19104.	39800.	0.	21408.	44600.	SUMNER TUNNEL
X80	2847	20956.	40300.	0.	20928.	43600.	0.	22656.	47200.	CALLAHAN TUNNEL

TABLE 1

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB1A	852.	10656.	22200.	1147.	14304.	29800.	1184.	14736.	30700.	LEV CIRC/XWAY SB
RB1B	852.	10656.	22200.	1147.	14304.	29800.	1184.	14736.	30700.	LEV CIRC/XWAY SB
RB2A	2000.	11328.	23600.	1460.	8304.	17300.	1406.	8304.	17300.	LEV CIRC/XWAY NB
RB3A	493.	5736.	11950.	944.	3888.	8100.	481.	3696.	7700.	ACC/XWAY NB
RB3B	1703.	12360.	25750.	1628.	10992.	22900.	1554.	11664.	24300.	ACC/XWAY NB
RB3D	1703.	12360.	25750.	1628.	10992.	22900.	1554.	11664.	24300.	ACC/XWAY NB
RB3E	2568.	14376.	29950.	2664.	13056.	27200.	2664.	13536.	28200.	ACC/XWAT NB
RB3F	368.	2376.	4950.	1332.	7056.	14700.	1443.	4944.	10300.	ACC/XWAY NB
RB4A	500.	4416.	9200.	74.	4128.	8600.	74.	5376.	11200.	MASS/OFF SB
RB5A	900.	1776.	3700.	1110.	3120.	6500.	1073.	2880.	6000.	MASS/ON SB
RB5B	900.	1776.	3700.	1110.	3120.	6500.	1073.	2880.	6000.	MASS/ON SB
RB6A	200.	3168.	6600.	703.	4656.	9700.	703.	5424.	11300.	MASS/ON NB
RB7A	500.	3720.	7750.	592.	3552.	7400.	592.	4032.	8400.	MASS/OFF NB
RB7B	500.	3720.	7750.	592.	3552.	7400.	592.	4032.	8400.	MASS/OFF NB
RB8A	150.	2328.	4850.	37.	288.	600.	37.	336.	700.	ANDREW OFF NB
RB8B	150.	2328.	4850.	37.	288.	600.	37.	336.	700.	ANDREW OFF NB
RB9A	800.	7344.	15300.	1073.	4848.	10100.	925.	5040.	10500.	ANDREW OFF SB
LB9B	0.	4608.	9600.	0.	0.	0.	0.	0.	0.	ANDREW OFF NB
PB10A	455.	6624.	13800.	814.	8256.	17200.	1073.	7968.	16600.	S STA OFF MASS PI
PB10C	455.	6624.	13800.	814.	8256.	17200.	1073.	7968.	16600.	S STA OFF MASS PI
PB11A	1625.	9672.	20150.	1702.	11664.	24300.	1850.	12528.	26100.	MASS PIKE
RB11B	415.	8784.	18300.	518.	11664.	24300.	444.	12528.	26100.	MASS PIKE
PB11C	700.	8784.	18300.	703.	7296.	15200.	629.	8784.	18300.	MASS PIKE
PB12A	2761.	12672.	26400.	2349.	13920.	29000.	3515.	12864.	26800.	MASS PIKE
PB12B	1431.	5712.	11900.	1628.	7872.	16400.	2553.	240.	500.	MASS PIKE
PB12C	1431.	5712.	11900.	1628.	8832.	18400.	2553.	8736.	18200.	MASS PIKE
PB13A	3259.	18768.	39100.	3626.	13008.	27100.	3552.	13200.	27500.	MASS PIKE
PB13B	700.	4284.	8925.	1776.	9408.	19600.	1110.	9216.	19200.	MASS PIKE
PB13C	1749.	12168.	25350.	1776.	9408.	19600.	1110.	9216.	19200.	MASS PIKE
RB15A	1330.	6960.	14500.	1221.	6048.	12600.	962.	12624.	26300.	OFF NB KNEEL
PB15B	1330.	6960.	14500.	1221.	6048.	12600.	962.	12624.	26300.	OFF NB KNEEL
RB16A	1705.	8904.	18550.	1369.	9984.	20800.	1443.	10368.	21600.	FANUEIL SB OFF
PB17A	1885.	11928.	24850.	1739.	10560.	22000.	1665.	10080.	21000.	FANUEIL SB ON
PB18A	1100.	12528.	26100.	1628.	11616.	24200.	1665.	11472.	23900.	N STA SB

TABLE 1 (CONT'D.)

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
PB18B	1100.	12528.	26100.	1628.	11616.	24200.	1665.	11472.	23900.	N STA SB
PB19A	1820.	10656.	22200.	999.	12240.	25500.	962.	12528.	26100.	N STA NB
PB20A	190.	1824.	3800.	1406.	5424.	11300.	1628.	5568.	11600.	NB 95
PB21A	1325.	9086.	18929.	1221.	6144.	12800.	1147.	6816.	14200.	STORROW WB
PB21B	1325.	9086.	18929.	1221.	6144.	12800.	1147.	6816.	14200.	STORROW WB
PB22A	473.	3243.	6757.	296.	4080.	8500.	259.	4032.	8400.	STORROW WB
PB22B	473.	3243.	6757.	296.	4080.	8500.	259.	4032.	8400.	STORROW WB
PB23A	918.	6295.	13114.	740.	5760.	12000.	259.	5520.	11500.	STORROW EB
PB24A	1103.	7515.	15657.	916.	6278.	13080.	938.	6432.	13400.	STORROW WB
PB26A	770.	8496.	17700.	1221.	0.	0.	1295.	0.	0.	COLUMBIA NB
PB27A	732.	5366.	11180.	1406.	0.	0.	1406.	0.	0.	COLUMBIA NB
PB28A	202.	6768.	14100.	1332.	1488.	3100.	1628.	1968.	4100.	
PB29A	1210.	5880.	12250.	1154.	5856.	12200.	1406.	5712.	11900.	
PB29B	1210.	5880.	12250.	1154.	5856.	12200.	1406.	5712.	11900.	
PB30A	2559.	14484.	30175.	2220.	7584.	15800.	962.	6240.	13000.	
PB31A	1505.	10848.	22600.	2109.	12336.	25700.	1702.	13200.	27500.	
PB32A	630.	6264.	13050.	1221.	5760.	12000.	1147.	6432.	13400.	

TABLE 1

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB4A	1458.	8996.	17300.	2183.	11336.	21800.	7406.	13208.	25400.	CONGRESS
LB4D	1036.	4472.	8600.	1116.	4160.	8000.	444.	4264.	8200.	MARTHA
LB4E	668.	4472.	8600.	719.	3900.	7500.	481.	4108.	7900.	LOMASNEY
LB7C	1522.	11306.	21743.	2183.	14040.	27000.	2373.	14404.	27700.	STU/KNEEL
LB9A	1516.	11262.	21657.	1739.	9880.	19000.	1850.	10504.	20200.	SUDBURY
LB12A	650.	6314.	12143.	915.	2028.	3900.	740.	4160.	8000.	PORTL/NASHUA
LB12BR	1752.	14300.	27500.	1887.	4732.	9100.	1739.	6292.	12100.	PORTL/NASHUA
LB12B	1707.	11011.	21175.	1839.	4732.	9100.	1073.	6292.	12100.	PORTL/NASHUA
LB12C	2788.	18772.	36100.	3003.	10400.	20000.	2183.	11336.	21800.	PORTL/NASHUA
LB12D	2788.	18772.	36100.	3003.	10400.	20000.	2183.	11336.	21800.	PORTL/NASHUA
LB13A	2478.	17940.	34500.	2664.	26260.	50500.	3071.	27352.	52600.	C RIVER DAM
LB15A	2085.	10270.	19750.	1998.	14248.	27400.	2146.	14040.	27000.	N WASH/CH BR
LB15B	3813.	19136.	36800.	5217.	23712.	45600.	5918.	25584.	49200.	N WASH/CH BR
LB16A	721.	5356.	10300.	1907.	7384.	14200.	1184.	7488.	14400.	ATLANTIC
LB16B	969.	5512.	10600.	1850.	10556.	20300.	2257.	10764.	20700.	ATLANTIC
LB16C	1769.	7618.	14650.	1739.	9360.	18000.	2294.	9620.	18500.	ATLANTIC
LB16D	2128.	11180.	21500.	2516.	12168.	23400.	2294.	13364.	25700.	ATLANTIC
LB17A	1263.	9382.	18043.	1110.	10400.	20000.	1443.	13416.	25800.	NORTH
LB17B	1926.	14307.	27514.	1998.	11076.	21300.	3686.	11544.	22200.	NORTH
LB17C	2847.	20956.	40300.	2737.	22672.	43600.	4070.	24544.	47200.	NORTH
LB18A	1684.	7332.	14100.	1826.	12688.	24400.	2182.	13312.	25600.	HERALD
LB19A	6028.	43680.	84000.	6956.	44772.	86100.	7141.	47112.	90600.	STORROW SB
LB19B	7913.	45719.	87922.	6808.	53716.	103300.	7474.	55900.	107500.	STORROW SB
LB19C	7913.	45719.	87922.	6808.	51948.	99900.	7474.	54132.	104100.	STORROW SB
LB19D	6995.	40415.	77722.	6068.	43316.	83300.	7474.	44980.	86500.	STORROW SB
LB19E	6143.	35493.	68256.	4662.	43316.	83300.	4921.	44980.	86500.	STORROW SB
LB19F	6143.	35493.	68256.	4662.	36660.	70500.	4921.	37596.	72300.	STORROW SB
LB19G	7207.	47554.	91450.	6253.	56888.	109400.	7030.	53144.	102200.	STORROW SB
LB19H	7207.	47554.	91450.	6253.	56888.	109400.	7030.	53144.	102200.	STORROW SB
LB19I	2621.	20202.	38850.	2627.	25896.	49800.	2627.	26000.	50000.	STORROW SB
LB19J	5770.	48932.	94100.	5254.	24388.	46900.	5180.	50960.	98000.	STORROW 2WAY
LB20H	2850.	23816.	45800.	2627.	24492.	47100.	2553.	24960.	48000.	STORROW NB
LB21A	2120.	15749.	30286.	2473.	12220.	23500.	2405.	9048.	17400.	ARTERY
LB21B	1101.	8179.	15729.	1591.	13572.	26100.	1887.	12532.	24100.	ARTERY

TABLE 1 (CONT'D.)

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB22A	405.	3009.	5766.	725.	572.	1100.	955.	4680.	9000.	SOUTH
LB23A	826.	572.	1100.	1184.	4940.	9500.	1295.	3952.	7600.	W 4TH
LB24A	959.	5031.	9675.	2664.	11492.	22100.	2590.	10712.	20600.	ALBANY
LB24B	959.	5031.	9675.	2664.	6968.	13400.	2590.	6552.	12600.	ALBANY
LB24C	2141.	7696.	14800.	2664.	8684.	16700.	2405.	7852.	15100.	ALBANY
LB24D	1727.	12688.	24400.	3996.	7020.	13500.	3256.	6448.	12400.	ALBANY
LB25A	1742.	12941.	24886.	1079.	8944.	17200.	1554.	8736.	16800.	PURCHASE
LB25B	1742.	12941.	24886.	1079.	13624.	26200.	1554.	13416.	25800.	PURCHASE
LB25C	2642.	19626.	37743.	2374.	11024.	21200.	2442.	10608.	20400.	PURCHASE
LB26A	950.	7383.	13571.	1420.	9846.	18100.	1887.	10227.	18800.	BLACKSTONE
LB26B	228.	1772.	3257.	1460.	12077.	22200.	1628.	11696.	21500.	BLACKSTONE
LB29A	2190.	14040.	27000.	3848.	17576.	33800.	4329.	19240.	37000.	RUTHERFORD W
LB29BB	2190.	14040.	27000.	3848.	17576.	33800.	4329.	19240.	37000.	RUTHERFORD
LB31A	2639.	22100.	42500.	2812.	20696.	39800.	3258.	23192.	44600.	SUMNER TUNNEL
LB31B	3375.	25071.	48214.	3515.	25740.	49500.	3674.	28184.	54200.	SUMNER TUNNEL

TABLE 1

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS1A	1129.	6344.	12200.	944.	7189.	13825.	981.	7358.	14150.	SUMMER
LS1B	1721.	7722.	14850.	1691.	10556.	20300.	1628.	10790.	20750.	SUMMER
LS1C	1721.	11388.	21900.	2405.	10556.	20300.	2442.	10790.	20750.	SUMMER
LS1D	1690.	11804.	22700.	2445.	16198.	31150.	2516.	16692.	32100.	SUMMER
LS1E	1690.	11804.	22700.	2445.	16198.	31150.	2516.	16692.	32100.	SUMMER
LS1F	1915.	14222.	27350.	2720.	18447.	35475.	2794.	18954.	36450.	SUMMER
LS1G	1326.	10556.	20300.	1998.	18447.	35475.	2257.	18954.	36450.	SUMMER
LS2A	376.	2720.	5000.	254.	2475.	4550.	259.	2611.	4800.	E 1ST
LS2B	376.	2258.	4150.	499.	2747.	5050.	499.	2679.	4925.	W 1ST
LS3A	750.	5549.	10200.	778.	4597.	8450.	778.	4706.	8650.	E BROAD
LS3B	750.	5549.	10200.	1054.	7276.	13375.	1129.	7643.	14050.	W BROAD
LS3C	2624.	11206.	20600.	2091.	7276.	13375.	2238.	7643.	14050.	W BROAD
LS4A	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10790.	20750.	COL/DAY
LS4B	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10790.	20750.	COL/DAY
LS4C	1418.	10036.	19300.	548.	10478.	20150.	629.	10790.	20750.	COL/DAY
LS4D	322.	3042.	5850.	548.	9256.	17800.	629.	9607.	18475.	SOUTH
LS4F	423.	4264.	8200.	1425.	9256.	17800.	1499.	9607.	18475.	SOUTH
LS5A	1398.	7020.	13500.	1739.	13455.	25875.	2183.	14222.	27350.	COL/OLD COL
LS5B	1448.	11310.	21750.	1739.	13455.	25875.	2183.	14222.	27350.	OLD COL
LS5C	1902.	13052.	25100.	2128.	14404.	27700.	2534.	15184.	29200.	OLD COL
LS5D	1506.	10660.	20500.	1679.	14404.	27700.	1998.	15184.	29200.	OLD COL
LS6A	1490.	7176.	13800.	1832.	11726.	22550.	1942.	12376.	23800.	DAY
LS7A	844.	5954.	11450.	841.	6760.	13000.	883.	7306.	14050.	BOST/DORCH
LS7B	746.	5512.	10600.	1091.	6760.	13000.	1165.	7306.	14050.	BOST/DORCH
LS7C	2124.	12194.	23450.	2145.	13234.	25450.	2479.	13338.	25650.	BOST/DORCH
LS7D	1570.	8450.	16250.	1460.	13234.	25450.	1615.	13338.	25650.	BOST/DORCH
LS7E	1332.	7176.	13800.	1090.	7784.	14970.	1185.	7852.	15100.	BOST/DORCH
LS7F	868.	2990.	5750.	705.	3245.	6240.	731.	3271.	6290.	BOST/DORCH
LS8A	268.	1924.	3700.	156.	5512.	10600.	188.	5720.	11000.	D ST
LS8B	608.	4290.	8250.	722.	5512.	10600.	722.	5720.	11000.	D ST
LS8C	587.	3796.	7300.	870.	5512.	10600.	870.	5720.	11000.	D ST
LS8D	659.	3380.	6500.	870.	5161.	9925.	870.	5668.	10900.	D ST
LS8E	612.	4546.	8743.	706.	5161.	9925.	713.	5668.	10900.	D ST
LS10A	573.	4576.	8800.	510.	3770.	7250.	665.	3822.	7350.	A ST

TABLE 1 (CONT'D.)

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS10B	914.	6227.	11975.	610.	7605.	14625.	665.	8125.	15625.	A ST
LS10C	1160.	7501.	14425.	1129.	7605.	14625.	1184.	8125.	15625.	A ST
LS11A	764.	4732.	9100.	1067.	6609.	12710.	1084.	6713.	12910.	VIADUCT
LS12A	208.	1222.	2350.	291.	1706.	3280.	295.	1732.	3330.	B ST NE
LS14A	904.	5382.	10350.	1147.	8554.	16450.	1165.	8424.	16200.	NORTHERN
LS14B	1042.	6292.	12100.	1147.	15730.	30250.	1366.	16822.	32350.	NORTHERN
LS14C	1577.	9386.	18050.	2220.	15730.	30250.	2257.	16822.	32350.	NORTHERN
LS15A	231.	1764.	3500.	615.	7333.	14550.	647.	7637.	15550.	CONGRESS
LS15B	985.	4862.	9350.	1950.	7566.	14550.	1967.	8086.	15550.	CONGRESS
LS15C	839.	4862.	9350.	2346.	7566.	14550.	1721.	8086.	15550.	CONGRESS
LS17A	515.	3629.	7200.	752.	338.	670.	770.	343.	680.	METCHER
LS18A	144.	975.	1875.	233.	1885.	3625.	256.	1885.	3625.	W 2ND
LS18B	354.	1781.	3425.	352.	1885.	3625.	388.	1885.	3625.	W 2ND

TABLE 1

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE2A	126.	858.	1650.	126.	858.	1650.	126.	858.	1650.	JEFFRIES
LE3A	306.	2184.	4200.	296.	2236.	4300.	296.	2340.	4500.	MAVERICK
LE3B	361.	2262.	4350.	391.	2236.	4300.	391.	2340.	4500.	MAVERICK
LE3C	374.	2574.	4950.	404.	2236.	4300.	404.	2340.	4500.	MAVERICK
LE3D	633.	4394.	8450.	651.	2236.	4300.	679.	2340.	4500.	MAVERICK
LE4A	234.	1248.	2400.	222.	1300.	2500.	222.	1404.	2700.	SUMNER
LE4B	475.	2600.	5000.	475.	1300.	2500.	475.	1404.	2700.	SUMNER
LE4C	436.	2600.	5000.	435.	1300.	2500.	436.	1404.	2700.	SUMNER
LE4D	387.	2782.	5350.	387.	1300.	2500.	387.	1404.	2700.	SUMNER
LE5A	78.	302.	600.	67.	302.	600.	67.	302.	600.	COTTAGE
LE5B	67.	252.	500.	67.	252.	500.	67.	252.	500.	COTTAGE
LE6A	171.	932.	1850.	171.	932.	1850.	171.	932.	1850.	ORLEANS
LE6B	132.	857.	1700.	114.	726.	1440.	114.	726.	1440.	ORLEANS
LE7A	122.	1040.	2000.	122.	1586.	3050.	122.	1586.	3050.	BREMEN
LE7B	454.	1586.	3050.	403.	1586.	3050.	403.	1586.	3050.	BREMEN
LE7C	449.	4420.	8500.	473.	6084.	11700.	531.	6292.	12100.	BREMEN
LE7D	395.	5954.	11450.	449.	6084.	11700.	543.	6292.	12100.	BREMEN
LE7E	189.	2145.	4125.	224.	2189.	4210.	261.	2272.	4370.	BREMEN
LE9A	333.	2938.	5650.	333.	2938.	5650.	333.	2938.	5650.	CHELSEA
LE9B	312.	1898.	3650.	352.	1898.	3650.	389.	1898.	3650.	CHELSEA
LE8C	663.	4550.	8750.	777.	6734.	12950.	888.	6942.	13350.	CHELSEA
LE9D	760.	8255.	15875.	765.	7644.	14700.	896.	8320.	16000.	CHELSEA
LE9E	1086.	8112.	15600.	870.	76440.	147000.	981.	83200.	160000.	CHELSEA
LE8F	744.	6890.	13250.	962.	7644.	14700.	1147.	8320.	16000.	CHELSEA
LE9A	385.	2340.	4500.	403.	2371.	4560.	412.	2387.	4590.	MERIDIAN
LE9B	858.	8320.	16000.	851.	8424.	16200.	888.	8476.	16300.	MERIDIAN
LE9C	897.	7147.	13745.	999.	6968.	13400.	1055.	7540.	14500.	MERIDIAN
LE9D	815.	6404.	12315.	868.	6968.	13400.	962.	7540.	14500.	MERIDIAN
LE12A	547.	4368.	8400.	555.	4420.	8500.	555.	4472.	8600.	BENNINGTON
LE12B	836.	5876.	11300.	851.	5928.	11400.	888.	5980.	11500.	BENNINGTON
LE12C	1114.	9945.	19125.	1776.	13052.	25100.	1850.	13728.	26400.	BENNINGTON
LE13A	60.	806.	1600.	74.	306.	1600.	74.	806.	1600.	SARATOGA
LE13B	146.	1159.	2300.	148.	1159.	2300.	148.	1159.	2300.	SARATOGA
LE13C	503.	4876.	9675.	510.	4944.	9810.	510.	4944.	9810.	SARATOGA

TABLE 1 (CONT'D.)

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE13D	684.	6854.	13600.	693.	4133.	8200.	693.	4385.	8700.	SARATOGA
LE14B	175.	1159.	2300.	222.	1260.	2500.	259.	1361.	2700.	MARION
LE15A	419.	2270.	4365.	461.	2392.	4600.	518.	2548.	4900.	CONDOR
LE15B	419.	2270.	4365.	461.	2392.	4600.	518.	2548.	4900.	CONDOR
LE16A	569.	3458.	6650.	596.	2392.	4600.	625.	2548.	4900.	E EAGLE
LE17A	352.	2243.	4450.	398.	2535.	5030.	440.	2802.	5560.	HAVRE
LE17B	41.	295.	586.	46.	333.	660.	51.	368.	730.	HAVRE
LE18A	414.	3146.	6050.	461.	3640.	7000.	555.	4160.	8000.	PORTER SB
LE18B	422.	988.	1900.	463.	3640.	7000.	573.	4160.	8000.	PORTER SB
LE18C	732.	3497.	6725.	671.	1274.	2450.	1019.	2418.	4650.	PORTER SB
LE18D	661.	3653.	7025.	714.	5200.	10000.	962.	6084.	11700.	PORTER NB
LE18E	658.	8177.	15725.	1500.	18668.	35900.	895.	11175.	21490.	PORTER NB
LE18F	525.	3939.	7575.	1197.	8996.	17300.	714.	5356.	10300.	PORTER NB
LE19A	1270.	10400.	20000.	1350.	18460.	35500.	2109.	22204.	42700.	ACCESS
LE19B	1863.	15314.	29450.	2516.	18356.	35300.	2960.	22204.	42700.	ACCESS
LE19C	2155.	16009.	30786.	2292.	17004.	32700.	3341.	24804.	47700.	ACCESS
LE19D	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19E	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19F	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19G	1590.	14783.	28429.	2565.	19032.	36600.	3247.	24128.	46400.	ACCESS
LE19H	1623.	13520.	26000.	2368.	16692.	32100.	2997.	20800.	40000.	ACCESS
LE19I	916.	4368.	8400.	962.	5980.	11500.	1221.	5200.	10000.	RAMP ON
LE19J	847.	8710.	16750.	1466.	10400.	20000.	1776.	12480.	24000.	RAMP ON
LE19K	533.	4472.	8600.	566.	5772.	11100.	851.	7124.	13700.	RAMP OFF
LE20A	477.	5408.	10400.	1620.	16120.	31000.	1777.	20124.	38700.	SERVICE RD
LE20B	1160.	8617.	16571.	1014.	7540.	14500.	1273.	9464.	18200.	SERVICE RD
LE20C	879.	4394.	8450.	1138.	5668.	10900.	1437.	7176.	13800.	SERVICE RD
LE20D	580.	4309.	8286.	525.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20E	505.	2834.	5450.	525.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20F	505.	2834.	5450.	525.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20G	505.	2834.	5450.	525.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20H	562.	3822.	7350.	525.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20I	562.	4628.	8900.	525.	5148.	9900.	777.	5668.	10900.	SERVICE RD
LE20J	967.	6162.	11850.	525.	5148.	9900.	777.	5668.	10900.	SERVICE RD
LE21A	2847.	20956.	40300.	3626.	22516.	43300.	3922.	24544.	47200.	TUNNEL NB 1A

TABLE 1 (CONT'D.)

ESTIMATED VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE21B	2847.	19344.	40300.	3626.	20784.	43300.	3922.	22656.	47200.	TUNNEL NB 1A
LE21C	2579.	17328.	36100.	3330.	18528.	38600.	3589.	19680.	41000.	TUNNEL NB 1A
LE21D	1309.	7728.	16100.	1480.	6912.	14400.	1480.	8640.	18000.	TUNNEL NB 1A
LE21E	1309.	7728.	16100.	1480.	6912.	14400.	1480.	8640.	18000.	TUNNEL NB 1A
LE21F	2225.	11760.	24500.	2442.	12432.	25900.	2701.	13440.	28000.	TUNNEL NB 1A
LE22A	2639.	22100.	42500.	2912.	22516.	43300.	3182.	24700.	47500.	TUNNEL NB 1A
LE22B	1902.	14424.	30050.	1776.	20784.	43300.	2072.	22800.	47500.	TUNNEL NB 1A
LE22C	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22D	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22F	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22E	1616.	10512.	21900.	1936.	10224.	21300.	1147.	16416.	34200.	TUNNEL NB 1A
LE22G	1616.	10512.	21900.	1936.	10224.	21300.	1147.	16416.	34200.	TUNNEL NB 1A
LE23A	3841.	22272.	46400.	3478.	22656.	47200.	3848.	25056.	52200.	TUNNEL NB 1A
LE23AA	2255.	14796.	30825.	2590.	19968.	41600.	2923.	22080.	46000.	TUNNEL NB 1A

TABLE 2

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NX1	8198.	64042.	133420.	12025.	68976.	143700.	12801.	69648.	145100.	XWAY 2WAY
NX3	9700.	77904.	162300.	14874.	81744.	170300.	15386.	82512.	171900.	XWAY 2WAY
NX5	9550.	70968.	147850.	14097.	81360.	169500.	15826.	82080.	171000.	XWAY 2WAY
NX7	10350.	78312.	163150.	15139.	78192.	162900.	15984.	79344.	165300.	XWAY NB
NX11	2500.	27456.	57200.	4810.	30768.	64100.	5291.	30384.	63300.	XWAY NB
NX13A	8450.	73776.	153700.	14763.	83232.	173400.	15725.	86112.	179400.	XWAY 2WAY
NX13B	6553.	66288.	138100.	6919.	37056.	77200.	7400.	37776.	78700.	XWAY 2WAY
NX15	5189.	53280.	111000.	4662.	27696.	57700.	5069.	28416.	59200.	XWAY NB
NX19	6532.	69024.	143800.	5291.	38592.	80400.	5550.	39696.	82700.	XWAY NB
NX21	6262.	69720.	145250.	5291.	38592.	80400.	5550.	39696.	82700.	XWAY NB
NX23	6262.	69720.	145250.	13098.	92496.	192700.	13283.	94656.	197200.	XWAY NB
NX25	7602.	78960.	164500.	13098.	92496.	192700.	13283.	94656.	197200.	XWAY NB
NX27	7602.	78960.	164500.	13098.	92496.	192700.	13283.	94656.	197200.	XWAY NB
NX29	7602.	78960.	164500.	10471.	67536.	140700.	11397.	69552.	144900.	XWAY NB
NX31	8042.	77616.	161700.	8066.	67536.	140700.	7918.	69552.	144900.	XWAY NB
NX33	8042.	77616.	161700.	9731.	80832.	168400.	9879.	84576.	176200.	XWAY 2WAY
NX35	5347.	34008.	70850.	5328.	37488.	78100.	4736.	38784.	80800.	1WAY NB
NX35A	3347.	22680.	47250.	3071.	24288.	50600.	2590.	26160.	54500.	1WAY NB
NX37	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX41	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX43	2180.	17088.	35600.	2035.	16464.	34300.	2183.	17856.	37200.	1WAY
NX45	2180.	17088.	35600.	2035.	16464.	34300.	2183.	17856.	37200.	1WAY SB
NX49	5295.	34800.	72500.	5291.	31440.	65500.	5550.	33840.	70500.	XWAY 2WAY
NX51	5295.	34800.	72500.	5291.	31440.	65500.	5550.	33840.	70500.	XWAY 2WAY
NX53	5260.	34176.	71200.	6475.	44064.	91800.	7141.	46464.	96800.	MASS PIKE
NX55	5260.	34176.	71200.	6475.	44064.	91800.	7141.	46464.	96800.	MASS PIKE
NX59	1953.	14712.	30650.	0.	0.	0.	0.	0.	0.	CITY SQ
NX61	3115.	17712.	36900.	3256.	14976.	31200.	3367.	15984.	33300.	CITY SQ
SX8	5250.	38736.	80700.	8195.	40656.	84700.	9102.	42192.	87900.	1WAY SB
SX10	5250.	38736.	80700.	8195.	40656.	84700.	9102.	42192.	87900.	1WAY SB
SX30A	3710.	34200.	71250.	4551.	46080.	96000.	4218.	47376.	98700.	1WAY SB
SX30B	1890.	23544.	49050.	2923.	28752.	59900.	2664.	29808.	62100.	1WAY SB
SX32	2150.	21768.	45350.	2479.	25248.	52600.	2220.	25488.	53100.	93
SX32A	5354.	39240.	81750.	9879.	83568.	174100.	8954.	86160.	179500.	93

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
SX38	895.	1872.	3900.	851.	3840.	8000.	1110.	4416.	9200.	93
SX42	4289.	21169.	44100.	4588.	25248.	52600.	4514.	26304.	54800.	93
SX44	6439.	42936.	89450.	7659.	53184.	110800.	7474.	54864.	114300.	93
SX46	6439.	42936.	89450.	7659.	53184.	110800.	7474.	54864.	114300.	93
NX70	0.	71520.	149000.	592.	2688.	5600.	740.	3072.	6400.	93 OFF SB -US1NB
NX71	0.	0.	0.	1998.	16896.	35200.	1850.	16800.	35000.	93 OFF NB TO US1NB
NX72	0.	0.	0.	2590.	19536.	40700.	2590.	19872.	41400.	93 CONNECT 93S-US1N
NX73	0.	0.	0.	2590.	19536.	40700.	2590.	19872.	41400.	ON TC US1 NB
NX74	0.	0.	0.	1184.	12624.	26300.	1073.	13488.	28100.	OFF US1 SB TO 93SB
NX75	0.	0.	0.	2072.	20832.	43400.	1998.	21888.	45600.	CONNECT US1SB-93NB
NX76	0.	0.	0.	2072.	20832.	43400.	1998.	21888.	45600.	ON TC 93SB
X77	5189.	53280.	111000.	6660.	40080.	83500.	7104.	40608.	84600.	DEWEY SQ TUNNEL
X78	6532.	69024.	143800.	6600.	40080.	83500.	7104.	40608.	84600.	DEWEY SQ TUNNEL
X79	2639.	22100.	42500.	2146.	16848.	35100.	2479.	18288.	38100.	SUMNER TUNNEL
X80	2847.	20956.	40300.	2886.	17328.	36100.	3071.	18816.	39200.	CALLAHAN TUNNEL
X81	0.	0.	0.	703.	7920.	16500.	888.	8976.	18700.	HBR TUN TO PIKE: 5A
X82	0.	0.	0.	814.	13008.	27100.	962.	14160.	29500.	PIKE TO NEW TUNNELS
X83	0.	0.	0.	1258.	5856.	12200.	1295.	6528.	13600.	HBR TUN TO CA SB:5A
X84	0.	0.	0.	777.	4416.	9200.	925.	7296.	15200.	SV RD /CA NB: 3A;5A
X85	0.	0.	0.	4884.	34800.	72500.	5291.	34032.	70900.	CTRL ART NB
X86	0.	0.	0.	3501.	30134.	62780.	4293.	34656.	72200.	NEW HBR TUN: 5A
X87	0.	0.	0.	3501.	30134.	62780.	4293.	34656.	72200.	NEW HBR TUN: 5A
X88	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X89	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X90	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X91	0.	0.	0.	4921.	35616.	74200.	5143.	36912.	76900.	CHANNEL TUN: 3A,6
X92	0.	0.	0.	4921.	35616.	74200.	5143.	36912.	76900.	CHANNEL TUN: 3A,6
X93	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A
X94	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A,5A
X95	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A,5A
X96	0.	0.	0.	0.	0.	0.	0.	0.	0.	IA TO NEW TUN:3A,5A
X97	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW TUN TO IA:3A,5A
X98	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGAN TO TUN: 3A,5A
X99	0.	0.	0.	0.	0.	0.	0.	0.	0.	TUN TO LOGAN: 3A,5A
X100	0.	0.	0.	3737.	27792.	57900.	4625.	28608.	59600.	LEV CIR/XWAY TUN

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
X101	0.	0.	0.	2650.	17294.	36030.	3442.	21672.	45150.	NEW TUN S BOS 5B,C
X102	0.	0.	0.	2650.	17294.	36030.	3442.	21672.	45150.	NEW TUN OPEN DEP
X103	0.	0.	0.	2502.	15974.	33280.	3331.	20232.	42150.	NEW TUN S BOS 5B,C
X104	0.	0.	0.	2312.	15365.	32010.	3182.	20208.	42100.	NEW TUN PLAZA 5B,C
X105	0.	0.	0.	2312.	15365.	32010.	3182.	20208.	42100.	NEW TUN S BOS 5B,C
X106	0.	0.	0.	2312.	15365.	32010.	3182.	20208.	42100.	NEW TUN X HBR 5B,C
X107	0.	0.	0.	2312.	15365.	32010.	3182.	20208.	42100.	NEW TUN BIF 5B,C
X108	0.	0.	0.	2312.	15365.	32010.	3182.	20208.	42100.	NEW TUN BIF 5B,C

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB1A	852.	10656.	22200.	0.	0.	0.	0.	0.	0.	LEV CIRC/XWAY SB
RB1B	852.	10656.	22200.	0.	0.	0.	0.	0.	0.	LEV CIRC/XWAY SB
RB2A	2000.	11328.	23600.	1184.	7536.	15700.	1110.	6816.	14200.	LEV CIRC/XWAY NB
RB3A	493.	5736.	11950.	518.	4608.	9600.	592.	3552.	7400.	ACC/XWAY NB
RB3B	1703.	12360.	25750.	1295.	12384.	25800.	1406.	12528.	26100.	ACC/XWAY NB
RB3D	1703.	12360.	25750.	1110.	11760.	24500.	1221.	13920.	29000.	ACC/XWAY NB
RB3E	2568.	14376.	29950.	2405.	14208.	29600.	2590.	16608.	34600.	ACC/XWAT NB
RB3F	368.	2376.	4950.	703.	5040.	10500.	666.	5280.	11000.	ACC/XWAY NB
RB4A	500.	4416.	9200.	222.	6000.	12500.	296.	6096.	12700.	MASS/OFF SB
RB5A	900.	1776.	3700.	962.	3264.	6800.	1036.	3696.	7700.	MASS/ON SB
RB5B	900.	1776.	3700.	962.	3264.	6800.	1036.	3696.	7700.	MASS/ON SB
RB6A	200.	3168.	6600.	851.	5088.	10600.	888.	5520.	11500.	MASS/ON NB
RB7A	500.	3720.	7750.	592.	2976.	6200.	592.	3168.	6600.	MASS/OFF NB
RB7B	500.	3720.	7750.	592.	2976.	6200.	592.	3168.	6600.	MASS/OFF NB
RB8A	150.	2328.	4850.	37.	384.	800.	37.	432.	900.	ANDREW OFF NB
RB8B	150.	2328.	4850.	37.	384.	800.	37.	432.	900.	ANDREW OFF NB
RB9A	800.	7344.	15300.	1033.	4320.	9000.	962.	5424.	11300.	ANDREW OFF SB
RB9B	0.	4608.	9600.	0.	0.	0.	0.	0.	0.	ANDREW OFF NB
RB10A	455.	6624.	13800.	740.	4128.	8600.	851.	4272.	8900.	S STA OFF MASS PI
RB10C	455.	6624.	13800.	740.	4128.	8600.	851.	4272.	8900.	S STA OFF MASS PI
RB11A	1625.	9672.	20150.	1184.	5136.	10700.	1295.	5232.	10900.	MASS PIKE
RB11B	415.	8784.	18300.	1184.	5136.	10700.	1295.	5232.	10900.	MASS PIKE
RB11C	700.	8784.	18300.	0.	0.	0.	0.	0.	0.	MASS PIKE
RB12A	2761.	12672.	26400.	2627.	11088.	23100.	2775.	11424.	23800.	MASS PIKE
RB12B	1431.	5712.	11900.	2146.	6624.	13300.	1850.	6672.	13900.	MASS PIKE
RB12C	1431.	5712.	11900.	2146.	6624.	13800.	1850.	6672.	13900.	MASS PIKE
RB13A	3259.	18768.	39100.	2701.	11136.	23200.	2627.	12144.	25300.	MASS PIKE
RB13B	700.	4284.	8925.	1295.	4636.	9658.	897.	4759.	9915.	MASS PIKE
RB13C	1749.	12168.	25350.	1295.	7248.	15100.	1295.	7152.	14900.	MASS PIKE
RB15A	1330.	6960.	14500.	851.	4464.	9300.	888.	4896.	10200.	OFF NB KNEEL
RB15B	1330.	6960.	14500.	851.	4464.	9300.	888.	4896.	10200.	OFF NB KNEEL
RB16A	1705.	8904.	18550.	888.	6960.	14500.	999.	7824.	16300.	XWAY SB TO CALH
RB17A	1885.	11928.	24850.	1591.	5184.	10800.	1591.	5136.	10700.	FANUEIL SB ON
RB18A	1100.	12528.	26100.	0.	0.	0.	0.	0.	0.	N STA SB

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB18B	1100.	12528.	26100.	0.	0.	0.	0.	0.	0.	N STA SB
RB19A	1820.	10656.	22200.	1628.	17328.	36100.	1591.	17520.	36500.	N STA NB
RB20A	190.	1824.	3800.	0.	0.	0.	0.	0.	0.	NB 95
RB21A	1325.	9086.	18929.	703.	6288.	13100.	1295.	6720.	14000.	STORROW WB
RB21B	1325.	9086.	18929.	703.	6288.	13100.	1295.	6720.	14000.	STORROW WB
RB22A	473.	3243.	6757.	740.	5040.	10500.	814.	5088.	10600.	STORROW WB
RB22B	473.	3243.	6757.	740.	5040.	10500.	814.	5088.	10600.	STORROW WB
RB23A	918.	6295.	13114.	407.	5376.	11200.	703.	5424.	11300.	STORROW EB
RB24A	1103.	7515.	15657.	407.	5760.	12000.	370.	5904.	12300.	STORROW WB
RB26A	770.	8496.	17700.	1332.	6720.	14000.	1332.	6720.	14000.	COLUMBIA NB
RB27A	732.	5366.	11180.	1517.	5472.	11400.	1703.	6144.	12800.	COLUMBIA NB
RB28A	202.	6768.	14100.	888.	4128.	8600.	888.	2880.	6000.	
RB29A	1210.	5880.	12250.	1184.	5136.	10700.	1295.	5232.	10900.	
RB29B	1210.	5880.	12250.	1184.	5136.	10700.	1295.	5232.	10900.	
RB30A	2559.	14484.	30175.	1739.	9168.	19100.	1739.	8736.	18200.	
RB31A	1505.	10848.	22600.	0.	0.	0.	0.	0.	0.	
RB32A	630.	6264.	13050.	0.	0.	0.	0.	0.	0.	
RB33	0.	0.	0.	2183.	8352.	17400.	1961.	8592.	17900.	NORTHERN TO XWAY
RB34	0.	0.	0.	703.	9936.	20700.	592.	9456.	19700.	XWAY SB TO SURF
RB35	0.	0.	0.	1554.	15600.	32500.	2072.	16080.	33500.	LEV CIR TO XWAY
RB36	0.	0.	0.	2183.	12192.	25400.	2553.	12528.	26100.	XWAY NB TO LEVT
NEB1	0.	0.	0.	1110.	6816.	14200.	1571.	8928.	18600.	NEW TUNNEL
NEB2	0.	0.	0.	925.	7228.	13900.	1295.	9516.	18300.	AIRPT EXIT RD
NEB3	0.	0.	0.	0.	0.	0.	0.	0.	0.	SERVICE CONNCT
NEB4	0.	0.	0.	0.	0.	0.	0.	0.	0.	AIRPT RD CONNCT
NEB5	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT TO TUNN
NEB6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
NEB7	0.	0.	0.	0.	0.	0.	0.	0.	0.	RP FROM EXIT RD
NEB8	0.	0.	0.	0.	0.	0.	0.	0.	0.	TO 1A
NEB9	0.	0.	0.	0.	0.	0.	0.	0.	0.	1A TO RP
NEB10	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT TO TUNN
NEB11	0.	0.	0.	0.	0.	0.	0.	0.	0.	SVC RD 5B,C
NEB12	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGAN EXIT RD 5B,C
NEB13	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGAN EXIT RD 5B,C
NEB14	0.	0.	0.	0.	0.	0.	0.	0.	0.	CROSS RD 5B,C

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS	
NEB15	0.	0.	0.	0.	0.	0.	0.	0.	0.	CROSS RD	5B,C
NEB16	0.	0.	0.	0.	0.	0.	0.	0.	0.	CROSS RD	5B,C
NEB17	0.	0.	0.	0.	0.	0.	0.	0.	0.	TERMINAL LOOP	5B,C
NEB18	0.	0.	0.	222.	2080.	4000.	333.	2704.	5200.	PTR TO NEWTUN	5B,C
NEB19	0.	0.	0.	0.	0.	0.	0.	0.	0.	1A TO NEW TUN	5C
NEB20	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGANTONEWTUN	5B,C
NEB21	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW TUN TO 1A	5C
NEB22	0.	0.	0.	925.	7228.	13900.	1295.	9516.	18300.	NEWTUN TO BIF	5B,C
NEB23	0.	0.	0.	1110.	7384.	14200.	1517.	9672.	18600.	NEWTUNTOLOGAN	5B,C
NEB24	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEWTUN TO BIF	5B,C
NEB25	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEWTUNTOLOGAN	5B,C
NEB26	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW TUN TO 1A	5C
NEB27	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGANTONEWTUN	5B,C
NEB28	0.	0.	0.	0.	0.	0.	0.	0.	0.	BIF ACC LOOP	5B,C
NEB29	0.	0.	0.	0.	0.	0.	0.	0.	0.	BIF ACC LOOP	5B,C
NEB30	0.	0.	0.	0.	0.	0.	0.	0.	0.	RP TO SVC RD	5B,C
NEB31	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGAN TO 1A	5B,C
NSB1	0.	0.	0.	1739.	6384.	13300.	1887.	8496.	17700.	RP TO MASS PI	
NSB2	0.	0.	0.	1739.	6384.	13300.	1887.	8496.	17700.	NB"CONNCTOR"	
NSB3	0.	0.	0.	4884.	34800.	72500.	5291.	34032.	70900.	CENTRL ARTERY	
NSB4	0.	0.	0.	777.	4416.	9200.	925.	7296.	15200.	RAMP FRM SERV RD	
NSB5	0.	0.	0.	814.	13008.	27100.	962.	14160.	29500.	RP FRM MASS PI	
NSB6	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE	
NSB7	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE	
NSB8	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE	
NSB9	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE	
NSB10	0.	0.	0.	0.	0.	0.	0.	0.	0.	RMP NEW CA/OLD	
NSB11	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT NEW CA/OLD	
NSB12	0.	0.	0.	0.	0.	0.	0.	0.	0.	3 LINKS SUMMER	
NSB13	0.	0.	0.	0.	0.	0.	0.	0.	0.	TO CA NB	
NSB14	0.	0.	0.	0.	0.	0.	0.	0.	0.	IN TUNNEL	
NSB1V	0.	0.	0.	1258.	5856.	12200.	1295.	6528.	13600.	CON CHANL TO XWY	
NSB5V	0.	0.	0.	703.	7920.	16500.	888.	8976.	18700.	RMP FRM CONNECTR	
NSB20	0.	0.	0.	3561.	30134.	62780.	4293.	34656.	72200.	NEW TUN OPEN SEC	
NSB21	0.	0.	0.	666.	5544.	11550.	666.	5592.	11650.	CONG TO TUNN SB	

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NSB22	0.	0.	0.	185.	7296.	15200.	185.	7392.	15400.	TUN NB TO CONGR
NSB23	0.	0.	0.	1028.	14280.	29750.	1112.	15192.	31650.	CONGRSS TO NORTHN
NSB24	0.	0.	0.	74.	528.	1100.	148.	720.	1500.	CONG TO TUNN NB
NSB25	0.	0.	0.	74.	528.	1100.	148.	720.	1500.	CONG TO TUNN NB
NSB26	0.	0.	0.	185.	912.	1900.	296.	1488.	3100.	TUNN SB TO CONG
NSB27	0.	0.	0.	185.	912.	1900.	296.	1488.	3100.	TUNN SB TO CONG
NSB28	0.	0.	0.	222.	1848.	3850.	260.	2160.	4500.	EB OFF TO SUM/HAUL
NSB29	0.	0.	0.	252.	864.	1800.	297.	1008.	2100.	HAUL RD TO TUN NB
NSB30	0.	0.	0.	123.	432.	900.	148.	504.	1050.	SUMMER TO TUN WB
NSB31	0.	0.	0.	78.	720.	1500.	99.	816.	1700.	EB OFF TO SUMMER
NSB32	0.	0.	0.	144.	1128.	2350.	161.	1344.	2800.	EB OFF TO HAUL RD
NSB33	0.	0.	0.	396.	1992.	4150.	458.	2352.	4900.	MASSPORT HAUL RD
NSB34	0.	0.	0.	407.	9144.	19050.	445.	9552.	19900.	EB TO CONG/SUM/HAU
NSB35	0.	0.	0.	222.	1848.	3850.	260.	2160.	4500.	EB OFF TO SUM/HAUL
NSB36	0.	0.	0.	185.	912.	1900.	296.	1488.	3100.	WB OFF TO CONG/NOR
NSB37	0.	0.	0.	375.	1296.	2700.	445.	1512.	3150.	ON WB FROM SUM/HAU
NSB38	0.	0.	0.	375.	1296.	2700.	445.	1512.	3150.	ON WB FROM SUM/HAU

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB4A	1458.	8996.	17300.	2183.	9152.	17600.	2368.	9828.	18900.	CONGRESS
LB4D	1036.	4472.	8600.	888.	5668.	10900.	851.	6084.	11700.	MARTHA
LB4E	668.	4472.	8600.	592.	2392.	4600.	629.	3068.	5900.	LOMASNEY
LB7C	1522.	11306.	21743.	851.	4628.	8900.	814.	5460.	10500.	STU/KNEEL
LB9A	1516.	11262.	21657.	2479.	14196.	27300.	2516.	14976.	28800.	SUDBURY
LB12A	850.	6314.	12143.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
B12BB	1752.	14300.	27500.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12B	1707.	11011.	21175.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12C	2788.	18772.	36100.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12D	2788.	18772.	36100.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB13A	2478.	17940.	34500.	2516.	27040.	52000.	3515.	27612.	53100.	C RIVER DAM
LB15A	2085.	10270.	19750.	1998.	10348.	19900.	2183.	11388.	21900.	N WASH/CH BR
LB15B	3813.	19136.	36800.	4218.	10608.	20400.	4958.	17264.	33200.	N WASH/CH BR
LB16A	721.	5356.	10300.	592.	5564.	10700.	361.	5304.	10200.	ATLANTIC
LB16B	969.	5512.	10600.	1924.	10348.	19900.	1998.	10244.	19700.	ATLANTIC
LB16C	1769.	7618.	14650.	2553.	11700.	22500.	2664.	11908.	22900.	ATLANTIC
LB16D	2128.	11180.	21500.	2479.	14664.	28200.	2775.	15600.	30000.	ATLANTIC
LB17A	1263.	9382.	18043.	518.	5772.	11100.	592.	6136.	11800.	NORTH
LB17B	1926.	14307.	27514.	1554.	12116.	23300.	1739.	13884.	26700.	NORTH
LB17C	2847.	20956.	40300.	1554.	12116.	23300.	1702.	13884.	26700.	NORTH
LB18A	1684.	7332.	14100.	2257.	11960.	23000.	2294.	12012.	23100.	HERALD
LB19A	6028.	43680.	84000.	5586.	39728.	76400.	6808.	41860.	80500.	STORROW SB
LB19B	7913.	45719.	87922.	4884.	34580.	66500.	5217.	35932.	69100.	STORROW SB
LB19C	7913.	45719.	87922.	6623.	48152.	92600.	7067.	51168.	98400.	STORROW SB
LB19D	6995.	40415.	77722.	5809.	39884.	76700.	5920.	40456.	77800.	STORROW SB
LB19E	6143.	35493.	68256.	5809.	39884.	76700.	5920.	40456.	77800.	STORROW SB
LB19F	6143.	35493.	68256.	6660.	48360.	93000.	7104.	48568.	93400.	STORROW SB
LB19G	7207.	47554.	91450.	6660.	48360.	93000.	7104.	48568.	93400.	STORROW SB
LB19H	7207.	47554.	91450.	7104.	55640.	107000.	7548.	51220.	98500.	STORROW SB
LB19I	2621.	20202.	38850.	888.	11492.	22100.	851.	11544.	22200.	STORROW SB
LB19J	5770.	48932.	94100.	2072.	19656.	37800.	1961.	18928.	36400.	STORROW 2WAY
LB20H	2850.	23816.	45800.	1184.	8164.	15700.	1110.	7384.	14200.	STORROW NB
LB21A	2120.	15749.	30286.	2294.	9568.	18400.	2217.	10244.	19700.	ARTERY
LB21B	1101.	8179.	15729.	1628.	7488.	14400.	1665.	4472.	8600.	ARTERY

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB22A	405.	3009.	5786.	185.	962.	1850.	148.	770.	1480.	SOUTH
LB23A	826.	572.	1100.	1116.	5538.	10650.	1258.	598.	1150.	W 4TH
LB24A	959.	5031.	9675.	2590.	12606.	24242.	3025.	13668.	26285.	ALBANY
LB24B	959.	5031.	9675.	2035.	9620.	18500.	2072.	10348.	19900.	ALBANY
LB24C	2141.	7696.	14800.	2294.	10452.	20100.	1961.	10920.	21000.	ALBANY
LB24D	1727.	12688.	24400.	2812.	6916.	13300.	3071.	6448.	12400.	ALBANY
LB25A	1742.	12941.	24886.	259.	1300.	2500.	259.	780.	1500.	PURCHASE
LB25B	1742.	12941.	24886.	1665.	14768.	28400.	2405.	14352.	27600.	PURCHASE
LB25C	2642.	19626.	37743.	1517.	4004.	7700.	1776.	4108.	7900.	PURCHASE
LB26A	950.	7383.	13571.	1369.	10173.	18700.	1369.	8432.	15500.	BLACKSTONE
LB26B	228.	1772.	3257.	2922.	14362.	26400.	2795.	15504.	28500.	BLACKSTONE
LB29A	2190.	14040.	27000.	3219.	13364.	25700.	3552.	13312.	25600.	RUTHERFORD W
B29BB	2190.	14040.	27000.	3219.	13364.	25700.	3552.	13312.	25600.	RUTHERFORD
LB31A	2639.	22100.	42500.	2146.	18252.	35100.	2479.	19812.	38100.	SUMNER TUNNEL
LB31B	3375.	25071.	48214.	1739.	11804.	22700.	1961.	12792.	24600.	SUMNER TUNNEL
LB34	0.	0.	0.	555.	15860.	30500.	814.	17732.	34100.	PURCHASE EXTENDED
LB35	0.	0.	0.	925.	15704.	30200.	1184.	16484.	31700.	PURCHASE EXTENDED
LB36	0.	0.	0.	1332.	14872.	28600.	1554.	16120.	31000.	PURCHASE EXTENDED
LB37	0.	0.	0.	717.	8008.	15400.	917.	9516.	18300.	SURFACE ART/CROSS
LB38	0.	0.	0.	0.	0.	0.	0.	0.	0.	SURF ART/CROSS ST

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS1A	1129.	6344.	12200.	944.	7189.	13825.	981.	7345.	14125.	SUMMER
LS1B	1721.	7722.	14850.	1590.	10556.	20300.	1629.	10712.	20600.	SUMMER
LS1C	1721.	11388.	21900.	2061.	15808.	30400.	2100.	15912.	30600.	SUMMER
LS1D	1690.	11804.	22700.	2105.	15808.	30400.	2368.	15912.	30600.	SUMMER
LS1E	1690.	11804.	22700.	2308.	17493.	33640.	2905.	18980.	36500.	SUMMER
LS1F	1915.	14222.	27350.	2853.	17493.	33640.	2905.	18980.	36500.	SUMMER
LS1G	1326.	10556.	20300.	2291.	17493.	33640.	2905.	18980.	36500.	SUMMER
LS2A	376.	2720.	5000.	258.	2475.	4550.	297.	2584.	4750.	E 1ST
LS2B	376.	2258.	4150.	500.	2747.	5050.	537.	2856.	5250.	W 1ST
LS3A	750.	5549.	10200.	778.	4597.	8450.	778.	4651.	8550.	E BROAD
LS3B	750.	5549.	10200.	1055.	7276.	13375.	1055.	7385.	13575.	W BROAD
LS3C	2624.	11206.	20600.	2000.	14226.	26150.	2090.	14443.	26550.	W BROAD
LS4A	1418.	10036.	19300.	1425.	10478.	20150.	1461.	10681.	20540.	COL/DAY
LS4B	1418.	10036.	19300.	1425.	10478.	20150.	1461.	10681.	20540.	COL/DAY
LS4C	1418.	10036.	19300.	1425.	10478.	20150.	1461.	10681.	20540.	COL/DAY
LS4D	322.	3042.	5850.	536.	10478.	20150.	576.	10681.	20540.	SOUTH
LS4E	423.	4264.	8200.	1324.	8866.	17050.	1424.	8996.	17300.	SOUTH
LS5A	1398.	7020.	13500.	1554.	11791.	22675.	1665.	12519.	24075.	COL/OLD COL
LS5B	1448.	11310.	21750.	1554.	11791.	22675.	1665.	12519.	24075.	OLD COL
LS5C	1902.	13052.	25100.	1944.	12740.	24500.	2054.	12519.	24075.	OLD COL
LS5D	1506.	10660.	20500.	1532.	12740.	24500.	1643.	12519.	24075.	OLD COL
LS6A	1490.	7176.	13800.	1832.	11726.	22550.	1869.	11882.	22850.	DAY
LS7A	844.	5954.	11450.	747.	4160.	8000.	1456.	4290.	8250.	BOST/DORCH
LS7B	746.	5512.	10600.	951.	5980.	11500.	1091.	6240.	12000.	BOST/DORCH
LS7C	2124.	12194.	23450.	2071.	12350.	23750.	2221.	13026.	25050.	BOST/DORCH
LS7D	1570.	8450.	16250.	2071.	12350.	23750.	2221.	13026.	25050.	BOST/DORCH
LS7E	1382.	7176.	13800.	2071.	12350.	23750.	2221.	13026.	25050.	BOST/DORCH
LS7F	868.	2990.	5750.	2071.	12350.	23750.	2221.	13026.	25050.	BOST/DORCH
LS8A	268.	1924.	3700.	328.	4368.	8400.	328.	4680.	9000.	D ST
LS8B	608.	4290.	8250.	649.	4368.	8400.	686.	4680.	9000.	D ST
LS8C	587.	3796.	7300.	633.	4472.	8600.	686.	4784.	9200.	D ST
LS8D	659.	3380.	6500.	633.	4472.	8600.	833.	4784.	9200.	D ST
LS8E	612.	4546.	8743.	633.	4472.	8600.	833.	4784.	9200.	D ST
LS10A	573.	4576.	8800.	535.	2886.	5550.	611.	3302.	6350.	A ST

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS10B	914.	6227.	11975.	1055.	6708.	12900.	1129.	7124.	13700.	A ST
LS10C	1160.	7501.	14425.	1055.	6708.	12900.	1129.	7124.	13700.	A ST
LS11A	764.	4732.	9100.	1018.	529.	1018.	1034.	538.	1034.	VIADUCT
LS12A	208.	1222.	2350.	270.	140.	270.	281.	146.	281.	B ST NE
LS14A	904.	5382.	10350.	920.	9958.	19150.	1111.	9464.	18200.	NORTHERN
LS14B	1042.	6292.	12100.	1107.	9958.	19150.	1284.	9464.	18200.	NORTHERN
LS14C	1577.	9386.	18050.	2446.	16978.	32650.	2553.	17680.	34000.	NORTHERN
LS15A	231.	1764.	3500.	796.	8316.	16500.	940.	8971.	17800.	CONGRESS
LS15B	985.	4862.	9350.	1763.	8580.	16500.	2303.	9256.	17800.	CONGRESS
LS15C	839.	4862.	9350.	1763.	8580.	16500.	1890.	9256.	17800.	CONGRESS
LS17A	515.	3625.	7200.	824.	429.	851.	662.	413.	820.	METCHER
LS18A	144.	975.	1875.	389.	1885.	3625.	389.	1989.	3825.	W 2ND
LS18B	354.	1781.	3425.	389.	1885.	3625.	389.	1989.	3825.	W 2ND

TABLE 2. (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE2A	126.	858.	1650.	125.	858.	1650.	126.	858.	1650.	JEFFRIES
LE3A	306.	2184.	4200.	151.	2236.	4300.	152.	2340.	4500.	MAVERICK
LE3B	361.	2262.	4350.	391.	2236.	4300.	391.	2340.	4500.	MAVERICK
LE3C	374.	2574.	4950.	404.	2236.	4300.	404.	2340.	4500.	MAVERICK
LE3D	633.	4394.	8450.	651.	2236.	4300.	679.	2340.	4500.	MAVERICK
LE4A	234.	1248.	2400.	222.	1300.	2500.	222.	1404.	2700.	SUMNER
LE4B	475.	2600.	5000.	475.	1300.	2500.	475.	1404.	2700.	SUMNER
LE4C	436.	2600.	5000.	435.	1300.	2500.	436.	1404.	2700.	SUMNER
LE4D	387.	2782.	5350.	387.	1300.	2500.	387.	1404.	2700.	SUMNER
LE5A	78.	302.	600.	64.	302.	600.	64.	302.	600.	COTTAGE
LE5B	67.	252.	500.	64.	252.	500.	64.	252.	500.	COTTAGE
LE6A	171.	932.	1850.	171.	932.	1850.	171.	932.	1850.	ORLEANS
LE6B	132.	857.	1700.	114.	726.	1440.	114.	726.	1440.	ORLEANS
LE7A	122.	1040.	2000.	122.	1586.	3050.	122.	1586.	3050.	BREMEN
LE7B	454.	1586.	3050.	403.	1586.	3050.	402.	1586.	3050.	BREMEN
LE7C	449.	4420.	8500.	463.	6188.	11900.	537.	6292.	12100.	BREMEN
LE7D	395.	5954.	11450.	469.	6188.	11900.	543.	6292.	12100.	BREMEN
LE7E	189.	2145.	4125.	224.	1778.	3420.	261.	1846.	3550.	BREMEN
LE8A	333.	2938.	5650.	333.	2938.	5650.	333.	3099.	5960.	CHELSEA
LE8B	312.	1898.	3650.	352.	1898.	3650.	389.	2002.	3850.	CHELSEA
LE8C	663.	4550.	8750.	628.	5798.	11150.	686.	6318.	12150.	CHELSEA
LE8D	760.	8255.	15875.	705.	5756.	11070.	703.	5621.	10810.	CHELSEA
LE8E	1086.	8112.	15600.	813.	6640.	12770.	962.	7696.	14800.	CHELSEA
LE8F	744.	6890.	13250.	1220.	6864.	13200.	1369.	7956.	15300.	CHELSEA
LE9A	385.	2340.	4500.	412.	1612.	3100.	412.	1747.	3360.	MERIDIAN
LE9B	858.	8320.	16000.	995.	3900.	7500.	931.	3952.	7600.	MERIDIAN
LE9C	897.	7147.	13745.	924.	7680.	14770.	954.	7336.	15070.	MERIDIAN
LE9D	815.	6404.	12315.	813.	6760.	13000.	869.	7140.	13730.	MERIDIAN
LE12A	547.	4368.	8400.	577.	442.	850.	555.	447.	860.	BENNINGTON
LE12B	836.	5876.	11300.	851.	5928.	11400.	888.	5980.	11500.	BENNINGTON
LE12C	1114.	9945.	19125.	1776.	13078.	25150.	1850.	13728.	26400.	BENNINGTON
LE13A	60.	806.	1600.	74.	806.	1600.	74.	806.	1600.	SARATOGA
LE13B	146.	1159.	2300.	148.	1159.	2300.	148.	1159.	2300.	SARATOGA
LE13C	503.	4876.	9675.	188.	4944.	9810.	188.	4944.	9810.	SARATOGA

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE13D	684.	6854.	13600.	247.	2772.	5500.	247.	2772.	5500.	SARATOGA
LE14B	175.	1159.	2300.	259.	1260.	2500.	277.	1094.	2170.	MARION
LE15A	419.	2270.	4365.	467.	2392.	4600.	507.	2392.	4600.	CONDOR
LE15B	419.	2270.	4365.	467.	2392.	4600.	507.	2392.	4600.	CONDOR
LE16A	569.	3458.	6650.	446.	2392.	4600.	464.	2392.	4600.	E EAGLE
LE17A	352.	2243.	4450.	346.	2535.	5030.	346.	2535.	5030.	HAVRE
LE17B	41.	295.	586.	37.	333.	660.	37.	333.	660.	HAVRE
LE18A	414.	3146.	6050.	388.	2132.	4100.	444.	2371.	4560.	PORTER SB
LE18B	422.	988.	1900.	500.	2756.	5300.	573.	3058.	5880.	PORTER SB
LE18C	732.	3497.	6725.	809.	4462.	8580.	994.	5304.	10200.	PORTER SB
LE18D	661.	3653.	7025.	704.	3879.	7460.	834.	4451.	8560.	PORTER NB
LE18E	658.	8177.	15725.	500.	2756.	5300.	844.	4446.	8550.	PORTER NB
LE18F	525.	3939.	7575.	533.	2860.	5500.	611.	3401.	6540.	PORTER NB
LE19A	1270.	10400.	20000.	1258.	8736.	16800.	1369.	10140.	19500.	ACCESS
LE19B	1863.	15314.	29450.	1924.	14508.	27900.	2220.	17264.	33200.	ACCESS
LE19C	2155.	16009.	30786.	1924.	14508.	27900.	2220.	17264.	33200.	ACCESS
LE19D	2070.	15377.	29571.	2187.	16484.	31700.	2601.	20228.	38900.	ACCESS
LE19E	2070.	15377.	29571.	2187.	16484.	31700.	2601.	20228.	38900.	ACCESS
LE19F	2070.	15377.	29571.	3120.	22412.	43100.	2691.	19656.	37800.	ACCESS
LE19G	1938.	14783.	28429.	2195.	15756.	30300.	2691.	20124.	38700.	ACCESS
LE19H	1823.	13520.	26000.	1998.	14352.	27600.	2441.	17680.	34000.	ACCESS
LE19I	916.	4368.	8400.	962.	5980.	11500.	1221.	8320.	16000.	RAMP ON
LE19J	847.	8710.	16750.	1036.	8216.	15800.	1221.	9360.	18000.	RAMP ON
LE19K	533.	4472.	8600.	666.	5772.	11100.	851.	7124.	13700.	RAMP OFF
LE20A	477.	5408.	10400.	1267.	13156.	25300.	1666.	30680.	59000.	SERVICE RD
LE20B	1160.	8617.	16571.	1408.	6138.	11800.	1779.	7852.	15100.	SERVICE RD
LE20C	879.	4394.	8450.	1138.	4628.	8900.	1458.	5928.	11400.	SERVICE RD
LE20D	580.	4309.	8286.	685.	7800.	15000.	877.	8424.	16200.	SERVICE RD
LE20E	505.	2834.	5450.	685.	7800.	15000.	0.	8424.	16200.	SERVICE RD
LE20F	505.	2834.	5450.	685.	3536.	6800.	777.	4004.	7700.	SERVICE RD
LE20G	505.	2834.	5450.	685.	3536.	6800.	777.	4004.	7700.	SERVICE RD
LE20H	562.	3822.	7350.	685.	3536.	6800.	777.	4004.	7700.	SERVICE RD
LE20I	562.	4628.	8900.	685.	3536.	6800.	777.	4004.	7700.	SERVICE RD
LE20J	967.	6162.	11850.	518.	3536.	6800.	592.	4004.	7700.	SERVICE RD
LE21A	2847.	20956.	40300.	3185.	19240.	37000.	3404.	20644.	39700.	TUNNEL NB 1A

TABLE 2 (CONT'D.)

TRAFFIC VOLUMES FOR TWO-LANE TUNNEL CONCEPT - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
.E21B	2847.	19344.	40300.	2722.	17760.	37000.	2907.	17760.	37000.	TUNNEL NB 1A
.E21C	2579.	17328.	36100.	2923.	15744.	32800.	3108.	16080.	33500.	TUNNEL NB 1A
.E21D	1309.	7728.	16100.	1665.	7680.	16000.	1739.	6720.	14000.	TUNNEL NB 1A
.E21E	1309.	7728.	16100.	2627.	7680.	16000.	2960.	6720.	14000.	TUNNEL NB 1A
.E21F	2225.	11760.	24500.	2627.	13200.	27500.	2960.	14400.	30000.	TUNNEL NB 1A
.E22A	2639.	22100.	42500.	2350.	19656.	37800.	2703.	21320.	41000.	TUNNEL NB 1A
.E22B	1902.	14424.	30050.	1517.	18144.	37800.	1776.	19680.	41000.	TUNNEL NB 1A
.E22C	1930.	14424.	30050.	1517.	13680.	28500.	1776.	14880.	31000.	TUNNEL NB 1A
.E22D	1930.	14424.	30050.	1517.	13680.	28500.	1776.	14880.	31000.	TUNNEL NB 1A
.E22E	1930.	14424.	30050.	1517.	13680.	28500.	1776.	14880.	31000.	TUNNEL NB 1A
.E22F	1616.	10512.	21900.	1147.	11424.	23800.	1295.	12816.	26700.	TUNNEL NB 1A
.E22G	1616.	10512.	21900.	1147.	11424.	23800.	1295.	12816.	26700.	TUNNEL NB 1A
.E23A	3841.	22272.	46400.	3774.	24624.	51300.	3330.	27216.	56700.	TUNNEL N3 1A
.E23AA	2255.	14796.	30825.	3757.	21696.	45200.	4181.	24240.	50500.	TUNNEL NB 1A

TABLE 3

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
LEVERETT CIRCLE
FOR THE 1 HOUR

	APPROACHES		
	CHARLES EB	CHARLES RIVER DAM	NASHUA WB
SIGNAL CYCLE LENGTH (SEC)	60	60	60
GREEN PHASE LENGTH (SEC)	24	27	22
NUMBER OF LANES	5	3	4
APPROACH CAPACITY (VPH)	3600	2430	2664
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	3551	1324	1471
1990 NO-BUILD	3441	814	3003
2-LANE CONCEPT	4044	762	1018
PREFERRED	3589	777	596
2010 NO-BUILD	4107	962	3183
2-LANE CONCEPT	4224	777	1204
PREFERRED	3737	777	659

TABLE 4

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
LEVERETT CIRCLE
FOR THE 8 HOUR

	APPROACHES		
	CHARLES EB	CHARLES RIVER DAM	NASHUA WB
SIGNAL CYCLE LENGTH (SEC)	60	60	60
GREEN PHASE LENGTH (SEC)	24	27	22
NUMBER OF LANES	5	3	4
APPROACH CAPACITY (VPH)	3600	2430	2664
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	2938	1398	832
1990 NO-BUILD	3478	1567	1300
2-LANE CONCEPT	3497	1606	1001
PREFERRED	3289	1560	1066
2010 NO-BUILD	3549	1014	1417
2-LANE CONCEPT	3517	1619	995
PREFERRED	3374	1632	1073

TABLE 5

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
BELL CIRCLE
FOR THE 1 HOUR

	APPROACHES				
	ROUTE 1 SB	ROUTE 1 NB THRU	RTE.1 NB RT.TURN	R.B.PKWY SB	R.B.PKWY NB
SIGNAL CYCLE LENGTH (SEC)	143	143	143	143	143
GREEN PHASE LENGTH (SEC)	74	74	74	60	74
NUMBER OF LANES	3	2	1	2	2
APPROACH CAPACITY (VPH)	2808	1872	936	1512	1872
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	896	948	569	1022	777
1990 NO-BUILD	925	1029	617	1258	875
2-LANE CONCEPT	962	1064	638	1295	1110
PREFERRED	888	1064	638	1221	1110
2010 NO-BUILD	999	1087	652	1073	1295
2-LANE CONCEPT	1073	1110	666	1332	1147
PREFERRED	999	1110	666	1295	1147

TABLE 6

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
BELL CIRCLE
FOR THE 8 HOUR

	APPROACHES				
	ROUTE 1 SB	ROUTE 1 NB THRU	RTE.1 NB RT.TURN	R.B.PKWY SB	R.B.PKWY NB
SIGNAL CYCLE LENGTH (SEC)	143	143	143	143	143
GREEN PHASE LENGTH (SEC)	74	74	74	60	74
NUMBER OF LANES	3	2	1	2	2
APPROACH CAPACITY (VPH)	2808	1872	936	1512	1872
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	1812	762	457	962	657
1990 NO-BUILD	879	578	347	1035	464
2-LANE CONCEPT	928	608	364	1024	755
PREFERRED	930	626	375	1047	715
2010 NO-BUILD	950	595	357	963	518
2-LANE CONCEPT	1005	652	391	986	845
PREFERRED	1027	663	397	988	761

TABLE 7

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST. AND X-WAY OFF RAMP
FOR THE 1 HOUR

	APPROACHES		
	KNEELAND EB	KNEELAND WB	X-WAY OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	33	31	59
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	1188	1116	3186
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	199	326	1330
1990 NO-BUILD	34	407	1221
2-LANE CONCEPT	37	296	851
PREFERRED	296	592	1036
2010 NO-BUILD	36	222	962
2-LANE CONCEPT	37	370	888
PREFERRED	296	481	1073

TABLE 8

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST. AND X-WAY OFF RAMP
FOR THE 8 HOUR

	APPROACHES		
	KNEELAND EB	KNEELAND WB	X-WAY OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	85	85	85
GREEN PHASE LENGTH (SEC)	24	21	49
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	1008	900	2088
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	345	458	943
1990 NO-BUILD	20	319	819
2-LANE CONCEPT	39	215	605
PREFERRED	319	299	865
2010 NO-BUILD	26	267	1710
2-LANE CONCEPT	72	253	663
PREFERRED	351	299	1001

TABLE 9

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST., SURFACE ARTERY, AND X-WAY ON RAMP
FOR THE 1 HOUR

	APPROACHES			
	KNEELAND SB	KNEELAND WB	SURFACE SB	KNEELAND EB - RT
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100
GREEN PHASE LENGTH (SEC)	47	28	42	80
NUMBER OF LANES	2	3	4	1
APPROACH CAPACITY (VPH)	1692	1512	3024	1440
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	532	595	1725	387
1990 NO-BUILD	636	703	2026	645
2-LANE CONCEPT	471	814	1880	780
PREFERRED	355	98	1913	542
2010 NO-BUILD	682	877	1856	571
2-LANE CONCEPT	474	768	1777	850
PREFERRED	352	136	2128	643

TABLE 10

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST., SURFACE ARTERY, AND X-WAY ON RAMP
FOR THE 8 HOUR

	APPROACHES			
	KNEELAND SB	KNEELAND WB	SURFACE SB	KNEELAND EB - RT
SIGNAL CYCLE LENGTH (SEC)	86	86	86	86
GREEN PHASE LENGTH (SEC)	43	21	31	65
NUMBER OF LANES	2	3	4	1
APPROACH CAPACITY (VPH)	1800	1296	2592	1350
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	494	553	1603	359
1990 NO-BUILD	580	728	1203	421
2-LANE CONCEPT	332	540	975	552
PREFERRED	277	64	1040	424
2010 NO-BUILD	584	1034	1196	424
2-LANE CONCEPT	572	611	1066	626
PREFERRED	244	94	1267	447

TABLE 11

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & SUMMER STREET
FOR THE 1 HOUR

	APPROACHES				
	ATLANTIC NB	SUMMER WB THRU	SUMMER WB RT	SUMMER EB THRU	SUMMER EB LT
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100	100
GREEN PHASE LENGTH (SEC)	25	35	15	52	28
NUMBER OF LANES	3	2	1	2	1
APPROACH CAPACITY (VPH)	1350	1260	270	1872	504
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	647	488	253	424	322
1990 NO-BUILD	896	632	499	1020	716
2-LANE CONCEPT	587	417	284	945	1048
PREFERRED	666	533	59	666	0
2010 NO-BUILD	1075	643	362	1131	1056
2-LANE CONCEPT	707	471	283	984	1023
PREFERRED	736	339	59	676	0

TABLE 12

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & SUMMER STREET
FOR THE 8 HOUR

	APPROACHES				
	ATLANTIC NB	SUMMER WB THRU	SUMMER WB RT	SUMMER EB THRU	SUMMER EB LT
SIGNAL CYCLE LENGTH (SEC)	86	86	86	86	86
GREEN PHASE LENGTH (SEC)	22	34	10	47	20
NUMBER OF LANES	3	2	1	2	1
APPROACH CAPACITY (VPH)	1404	1440	216	1980	414
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	601	453	235	340	299
1990 NO-BUILD	923	592	312	767	598
2-LANE CONCEPT	696	186	126	709	786
PREFERRED	757	267	25	595	0
2010 NO-BUILD	936	761	358	740	618
2-LANE CONCEPT	663	272	163	766	736
PREFERRED	708	250	26	604	0

TABLE 13

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & CONGRESS STREET
FOR THE 1 HOUR

	APPROACHES			
	ATLANTIC NB	CONGRESS NWB	CONGRESS SEB THRU	CONGRESS SEB LT
SIGNAL CYCLE LENGTH (SEC)	90	90	90	90
GREEN PHASE LENGTH (SEC)	21	26	61	31
NUMBER OF LANES	2	2	2	1
APPROACH CAPACITY (VPH)	828	1004	2448	612
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	969	631	777	365
1990 NO-BUILD	1866	962	1066	261
2-LANE CONCEPT	1920	749	1189	130
PREFERRED	488	1133	305	120
2010 NO-BUILD	2247	1119	1121	248
2-LANE CONCEPT	1997	810	1300	123
PREFERRED	545	1147	404	80

TABLE 14

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & CONGRESS STREET
FOR THE 8 HOUR

	APPROACHES			
	ATLANTIC NB	ATLANTIC NWB	CONGRESS SEB THRU	CONGRESS SEB LT
SIGNAL CYCLE LENGTH (SEC)	83	83	83	83
GREEN PHASE LENGTH (SEC)	20	24	37	28
NUMBER OF LANES	2	2	2	1
APPROACH CAPACITY (VPH)	864	1044	1620	612
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	689	553	1047	552
1990 NO-BUILD	1320	345	800	423
2-LANE CONCEPT	1294	33	1119	122
PREFERRED	321	61	303	167
2010 NO-BUILD	1346	494	873	462
2-LANE CONCEPT	1281	72	1182	112
PREFERRED	359	61	388	100

TABLE 15

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/NORTHERN AVENUE/OLIVER STREET
FOR THE 1 HOUR

	APPROACHES		
	ATLANTIC AVENUE	NORTHERN AVENUE	OLIVER STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	51	41	41
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	2754	1476	1476
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	1769	1304	0
1990 NO-BUILD	1724	1825	0
2-LANE CONCEPT	0	0	0
PREFERRED	2348	1563	37
2010 NO-BUILD	2306	1850	0
2-LANE CONCEPT	0	0	0
PREFERRED	2355	1603	37

TABLE 16

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/NORTHERN AVENUE/OLIVER STREET
FOR THE 8 HOUR

	APPROACHES		
	ATLANTIC AVENUE	NORTHERN AVENUE	OLIVER STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	60	32	32
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	3240	1152	1152
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	953	637	0
1990 NO-BUILD	1040	1612	0
2-LANE CONCEPT	0	0	0
PREFERRED	1677	897	26
2010 NO-BUILD	1203	1710	0
2-LANE CONCEPT	0	0	0
PREFERRED	1735	875	26

TABLE 17

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
N. WASHINGTON STREET & COMMERCIAL STREET
FOR THE 1 HOUR

	APPROACHES			
	CAUSEWAY EB	COMMERC'L WB	N.WASH.ST NB	N.WASH.ST SB
SIGNAL CYCLE LENGTH (SEC)	127	127	127	127
GREEN PHASE LENGTH (SEC)	47	18	60	60
NUMBER OF LANES	2	3	2	3
APPROACH CAPACITY (VPH)	1332	756	1692	2538
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	1148	1062	1238	1161
1990 NO-BUILD	2317	1020	740	2331
2-LANE CONCEPT	917	891	1341	1831
PREFERRED	922	888	1584	2072
2010 NO-BUILD	1776	864	777	2701
2-LANE CONCEPT	1379	1093	1175	2066
PREFERRED	962	1036	1628	2220

TABLE 18

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
N. WASHINGTON STREET & COMMERCIAL STREET
FOR THE 8 HOUR

	APPROACHES			
	CAUSEWAY EB	COMMERC'L WB	N.WASH.ST NB	N.WASH.ST SB
SIGNAL CYCLE LENGTH (SEC)	127	127	127	127
GREEN PHASE LENGTH (SEC)	47	18	60	60
NUMBER OF LANES	2	3	2	3
APPROACH CAPACITY (VPH)	1332	756	1692	2538
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	725	582	588	1222
1990 NO-BUILD	1463	559	774	1372
2-LANE CONCEPT	709	506	761	683
PREFERRED	559	475	813	624
2010 NO-BUILD	1034	473	813	1482
2-LANE CONCEPT	696	527	852	780
PREFERRED	650	481	865	787

TABLE 19

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQUARE (CHARLESTOWN)
FOR THE 1 HOUR

	APPROACHES	
	N.WASH.ST NB	CHELSEA WB
SIGNAL CYCLE LENGTH (SEC)	110	110
GREEN PHASE LENGTH (SEC)	76	34
NUMBER OF LANES	3	1
APPROACH CAPACITY (VPH)	2850	433
DEMAND VOLUMES (VPH) by Alternative:		
1982 EXISTING	2754	410
1990 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0
2010 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0

TABLE 20

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQUARE (CHARLESTOWN)
FOR THE 8 HOUR

	APPROACHES	
	N.WASH.ST NB	CHELSEA WB
SIGNAL CYCLE LENGTH (SEC)	80	80
GREEN PHASE LENGTH (SEC)	35	45
NUMBER OF LANES	3	1
APPROACH CAPACITY (VPH)	1805	788
DEMAND VOLUMES (VPH) by Alternative:		
1982 EXISTING	1008	429
1990 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0
2010 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0

TABLE 22

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQ/N.WASH/RUTHERFORD/CHELSEA/XWAY OFF RAMP
FOR THE 8 HOUR

	APPROACHES			
	N.WASH.ST NB	RUTHRFD SB	CHELSEA WB	X-WAY OFF RAMP EB
SIGNAL CYCLE LENGTH (SEC)	120	120	120	120
GREEN PHASE LENGTH (SEC)	32	22	28	48
NUMBER OF LANES	6	5	3	3
APPROACH CAPACITY (VPH)	2200	1260	963	1650
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	1593	793	793	1086
2-LANE CONCEPT	1294	813	884	1203
PREFERRED	1177	767	826	1164
2010 NO-BUILD	1846	813	800	1216
2-LANE CONCEPT	1378	748	994	1287
PREFERRED	1313	760	923	1320

TABLE 21

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQ/N.WASH/RUTHERFORD/CHELSEA/XWAY OFF RAMP
FOR THE 1 HOUR

	APPROACHES			
	N.WASH.ST NB	RUTHR'FD SB	CHELSEA WB	X-WAY OFF RAMP EB
SIGNAL CYCLE LENGTH (SEC)	120	120	120	120
GREEN PHASE LENGTH (SEC)	34	33	32	26
NUMBER OF LANES	6	5	3	3
APPROACH CAPACITY (VPH)	2338	1891	1100	894
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	2886	1924	1443	1147
2-LANE CONCEPT	2382	1548	1398	1059
PREFERRED	2553	1663	1470	1036
2010 NO-BUILD	3219	2146	1480	1221
2-LANE CONCEPT	2875	1649	1384	1169
PREFERRED	2767	1793	1480	1258

TABLE 23

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST..NEW ARTERY SB OFF RAMP/SB CONNECTOR
FOR THE 1 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	X-WAY OFF RAMP SB
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	25	25	55
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	1219	1219	997
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	517	1365	760
PREFERRED	522	1378	886
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	571	1387	743
PREFERRED	555	1434	939

TABLE 24

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY SB OFF RAMP/SB CONNECTOR
FOR THE 8 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	X-WAY OFF RAMP SB
SIGNAL CYCLE LENGTH (SEC)	70	70	70
GREEN PHASE LENGTH (SEC)	25	25	45
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	1393	1393	932
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	481	1112	910
PREFERRED	436	930	839
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	494	1131	930
PREFERRED	475	956	806

TABLE 25

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY NB ON RAMP/NB CONNECTOR
FOR THE 1 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	NB CONNECTOR
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	31	31	49
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	1511	1511	1776
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	439	1130	961
PREFERRED	372	1110	1064
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	485	1141	1340
PREFERRED	444	1295	1149

TABLE 26

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY NB ON RAMP/NB CONNECTOR
FOR THE 8 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	NB CONNECTOR
SIGNAL CYCLE LENGTH (SEC)	70	70	70
GREEN PHASE LENGTH (SEC)	30	30	40
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	1671	1671	1657
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	176	988	787
PREFERRED	156	852	618
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	176	982	813
PREFERRED	156	917	644

TABLE 27

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVE/SURFACE ARTERY/STATE STREET
FOR THE 1 HOUR

	APPROACHES				
	ATLANTIC NB	ATLANTIC SB	SURFACE SB	SURFACE NB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100	100
GREEN PHASE LENGTH (SEC)	50	50	45	45	55
NUMBER OF LANES	3	3	3	3	2
APPROACH CAPACITY (VPH)	1950	1950	1755	1755	1320
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	1214	576	1210	1400	515
1990 NO-BUILD	1702	1073	1110	1480	703
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0
2010 NO-BUILD	1591	1110	1332	1591	725
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0

TABLE 28

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVE./SURFACE ARTERY/STATE STREET
FOR THE 8 HOUR

	APPROACHES				
	ATLANTIC NB	ATLANTIC SB	SURFACE SB	SURFACE NB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	70	70	70	70	70
GREEN PHASE LENGTH (SEC)	34	34	29	29	41
NUMBER OF LANES	3	3	3	3	2
APPROACH CAPACITY (VPH)	1894	1894	1616	1616	1406
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	520	662	1024	946	346
1990 NO-BUILD	572	728	995	878	364
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0
2010 NO-BUILD	696	904	910	884	450
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0

TABLE 29

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/SURFACE ARTERY/STATE STREET
FOR THE 1 HOUR

	APPROACHES		
	ATLANTIC NB	SURFACE SB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	45	45	45
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	2063	2063	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1797	1319	555
PREFERRED	1245	1142	185
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	2038	1545	592
PREFERRED	1345	1238	196

TABLE 39

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/SURFACE ARTERY/STATE STREET
FOR THE 8 HOUR

	APPROACHES		
	ATLANTIC NB	SURFACE SB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	41	41	39
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	2114	2114	1170
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1229	1066	709
PREFERRED	650	1248	260
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	1300	1151	715
PREFERRED	663	1261	267

TABLE 3

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & WEST TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	CONGRESS STREET	TUNNEL CONNECTOR	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	30	60	60
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	1800	2400	2400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	496	505	395
PREFERRED	467	829	541
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	555	528	507
PREFERRED	475	841	691

TABLE 32

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & WEST TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	CONGRESS STREET	TUNNEL CONNECTOR	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	30	60	60
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	1800	2400	2400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	719	235	1111
PREFERRED	530	172	858
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	806	260	1286
PREFERRED	586	190	949

TABLE 33

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
SUMMER ST. & TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	SUMMER WB	SUMMER EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	70	70	20
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	4200	4200	400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	902	1163	89
PREFERRED	1001	1170	284
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	914	1201	113
PREFERRED	1002	1210	210

TABLE 34

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
SUMMER ST. & TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	SUMMER WB	SUMMER EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	70	70	20
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	4200	4200	400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	449	429	105
PREFERRED	1674	1601	364
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	508	486	119
PREFERRED	1680	1638	364

TABLE 35

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NORTHERN AVE & EAST TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	NORTHERN WB	NORTHERN EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	60	60	30
NUMBER OF LANES	2	2	2
APPROACH CAPACITY (VPH)	2400	2400	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	555	581	163
PREFERRED	626	437	114
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	639	677	184
PREFERRED	673	434	84

TABLE 36

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NORTHERN AVE & EAST TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	NORTHERN WB	NORTHERN EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	60	60	30
NUMBER OF LANES	2	2	2
APPROACH CAPACITY (VPH)	2400	2400	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	254	293	165
PREFERRED	191	223	117
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	322	371	196
PREFERRED	191	223	117

TABLE 37

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & SEAPORT ACCESS ROAD
FOR THE 1 HOUR

	APPROACHES			
	CONGRESS SB	CONGRESS NB	SEAPORT EB	SEAPORT EB
SIGNAL CYCLE LENGTH (SEC)	80	80	80	80
GREEN PHASE LENGTH (SEC)	34	34	46	46
NUMBER OF LANES	2	2	2	2
APPROACH CAPACITY (VPH)	1530	1530	2070	2070
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	349	407	370	851
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0
2010 NO-BUILD	375	629	407	851
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0

TABLE 38

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & SEAPORT ACCESS ROAD
FOR THE 8 HOUR

	APPROACHES			
	CONGRESS SB	CONGRESS NB	SEAPORT EB	SEAPORT WB
SIGNAL CYCLE LENGTH (SEC)	80	80	80	80
GREEN PHASE LENGTH (SEC)	34	34	46	46
NUMBER OF LANES	2	2	2	2
APPROACH CAPACITY (VPH)	1530	1530	2070	2070
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	689	254	247	702
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0
2010 NO-BUILD	650	267	302	728
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0

TABLE 39

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON ST./NEW CHARDON/CROSS ST.
FOR THE 1 HOUR

	APPROACHES		
	N.WASH.ST SB	N.WASH.ST NB	CROSS STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	67	67	33
NUMBER OF LANES	3	2	1
APPROACH CAPACITY (VPH)	2764	1843	454
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	1161	621	279
1990 NO-BUILD	1147	703	629
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0
2010 NO-BUILD	1221	777	666
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0

TABLE 40

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON ST./NEW CHARDON/CROSS ST.
FOR THE 8 HOUR

	APPROACHES		
	N.WASH.ST SB	N.WASH.ST NB	CROSS WB
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	59	59	31
NUMBER OF LANES	3	2	1
APPROACH CAPACITY (VPH)	2704	1803	474
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	813	195	309
1990 NO-BUILD	845	735	540
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0
2010 NO-BUILD	761	767	748
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0

TABLE 41

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON/SB CONNECTOR/CROSS/NEW CHARDON
FOR THE 1 HOUR .

APPROACHES

	N.WASH.ST NB	SB CONNECTOR	SUM OFF R &CROSS WB
SIGNAL CYCLE LENGTH (SEC)	130	130	130
GREEN PHASE LENGTH (SEC)	43	53	44
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	910	1682	1396
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1221	2049	1659
PREFERRED	1110	1815	851
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	1184	1965	1903
PREFERRED	1147	1146	1149

TABLE 42

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON/SB CONNECTOR/CROSS/NEW CHARDON
FOR THE 8 HOUR

	APPROACHES		
	N.WASH.ST NB	SB CONNECTOR	SUM OFF R &CROSS WB
SIGNAL CYCLE LENGTH (SEC)	120	120	120
GREEN PHASE LENGTH (SEC)	33	54	43
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	756	1238	1478
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	787	1151	1503
PREFERRED	715	1046	774
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	845	1281	1684
PREFERRED	814	747	1017

TABLE 43

TRAFFIC INPUT DATA FOR SUMNER TUNNEL TOLL BOOTHS

	Peak Hour			Eight Hour		
Alternative	Demand Volume*	Queue Length*	Average Delay*	Demand Volume	Queue Length	Average Delay
1982 Existing	2850	75	5.75	2420	28	2.16
1990 No-Build	2812	195	10.75	2587	73	4.00
2 Lane Concept	2146	1	0.28	2282	0.375	0.105
Preferred	1591	1	0.26	1664	0.375	0.0975
2010 No-Build	3258	225	12.50	2899	84	4.75
2 Lane Concept	2479	180	9.48	2477	67.5	3.555
Preferred	1998	1	0.27	1924	0.375	0.1013

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (3 lanes total), and average delay is in minutes per vehicle.

TABLE 44

TRAFFIC INPUT DATA FOR CALLAHAN TUNNEL ENTRANCE

	Peak Hour			Eight Hour		
Alternative	Demand Volume*	Queue Length*	Average Delay*	Demand Volume	Queue Length	Average Delay
1982 Existing	2850	19	2.68	2420	7	1.01
1990 No-Build	3737	132	4.85	2847	50	1.80
2 Lane Concept	2886	0	0	2347	0	0
Preferred	2146	0	0	1775	0	0
2010 No-Build	4070	171	6.30	3068	64	2.40
2 Lane Concept	3071	48	0.85	2548	18	.3188
Preferred	2479	0	0	2067	0	0

*Demand volumes are in vehicles per hour, queue length is in vehicles per approach lane (3 lanes total), delay is in minutes per vehicle.

TABLE 45

TRAFFIC INPUT DATA FOR CALLAHAN TUNNEL TOLL BOOTHS

	Peak Hour			Eight Hour		
Alternative	Demand Volume*	Queue Length*	Average Delay*	Demand Volume	Queue Length	Average Delay
1982 Existing	2850	4	0.57	2420	4	0.61
1990 No-Build	3737	235	8.65	2847	88	3.25
[1]2 Lane Concept	2886	20	0.79	2347	7.5	0.2963
[2]Preferred	2146	0	0	1775	0	0
2010 No-Build	4070	392	14.50	3068	147	5.50
[1]2 Lane Concept	3071	56	1.49	2548	21	0.559
[2]Preferred	2479	0	0	2067	0	0

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (7 lanes total, 6 for 8-hr), and average delay is in minutes per vehicle.

[1]Two-way toll.

[2]One-way toll at Sumner Tunnel - no toll at Callahan.

TABLE 46

TRAFFIC INPUT DATA FOR PROPOSED TUNNEL TOLL BOOTHS - NORTHBOUND

	Peak Hour			Eight Hour		
Alternative	Demand Volume*	Queue Length*	Average Delay*	Demand Volume	Queue Length	Average Delay
1982 Existing	NA**	NA	NA	NA	NA	NA
1990 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1258	3	0.52	966	1.125	0.195
[2]Preferred	2150	0	0	1752	0	0
2010 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1702	28	1.37	1272	10.5	0.5138
[2]Preferred	2520	0	0	2064	0	0

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane, and average delay is in minutes per vehicle.

**NA means not applicable.

[1]Number of approach lanes for the 2 Lane Concept is 1. Toll is two way.

[2]Number of approach lanes for the Preferred Alternative is 2. Toll is one way (southbound only).

TABLE 47

TRAFFIC INPUT DATA FOR PROPOSED TUNNEL TOLL BOOTHS - SOUTHBOUND

	Peak Hour			Eight Hour		
Alternative	Demand Volume*	Queue Length*	Average Delay*	Demand Volume	Queue Length	Average Delay
1982 Existing	NA	NA	NA	NA	NA	NA
1990 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1036	1	0.44	942	0.375	0.165
[2]Preferred	1702	1	0.35	1740	0.375	0.1313
2010 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1443	7	0.66	1254	2.625	0.2475
[2]Preferred	2146	4	0.42	1998	1.5	0.1575

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (2 lanes total), and average delay is in minutes per vehicle.

**NA means not applicable.

[1]Number of approach lanes for the 2 Lane Concept is 1.

[2]Number of approach lanes for the Preferred Alternative is 2.

TABLE 48

AVERAGE ROUTE SPEED BY FACILITY TYPE AND GEOGRAPHIC AREA FOR PEAK HOUR

Location	Facility Type	Average Speed by Alternative and Year in Miles Per Hour					
		1990			2010		
		1	5A.2[1]	5A.7[2]	1	5A.2[1]	5A.7[2]
Boston	Expressway	26	30	38	24	38	38
	Arterial	24	22	24	22	24	24
	Collector	20	20	20	19	20	20
	Local	16	20	20	15	20	20
South Boston	Expressway	34	35	35	32	33	33
	Arterial	25	26	26	23	26	26
	Collector	22	22	22	21	22	22
	Local	21	21	21	21	21	20
	Proposed Tunnel	NA*	35	40	NA	32	37
East Boston	Route 1A	32	35	35	31	34	34
	All Tunnels	21	35	35	16	34	34
	Arterial	22	23	23	21	22	22
	Collector	21	21	21	20	21	21
	Local	21	21	21	20	21	21

*NA means not applicable.

1 Refers to the 2 Lane Tunnel Concept.

2 Refers to the Preferred Alternative.

TABLE 49

AVERAGE ROUTE SPEED BY FACILITY TYPE AND GEOGRAPHIC AREA FOR 8- AND 24-HOUR

		Average Speed by Alternative and Year in Miles Per Hour					
		1990			2010		
Location	Facility Type	1	5A.2[1]	5A.7[2]	1	5A.2[1]	5A.7[2]
Boston	Expressway	39	48	48	36	48	48
	Arterial	29	29	29	28	29	29
	Collector	25	25	25	24	25	25
	Local	23	24	24	22	24	24
South Boston	Expressway	47	48	48	45	47	46
	Arterial	31	31	31	30	31	31
	Collector	27	27	27	26	26	26
	Local	25	25	25	24	24	24
	Proposed Tunnel	NA*	39	44	NA	37	42
East Boston	Route 1A	36	39	39	35	35	39
	All Tunnels	26	38	38	24	38	38
	Arterial	27	27	27	25	26	26
	Collector	24	24	24	24	24	24
	Local	24	24	24	24	24	24

*NA means not applicable.

1 Refers to 2 Lane Tunnel Concept.

2 Refers to the Preferred Alternative.

TABLE 50

EXISTING TUNNELS - INPUT PARAMETERS

		Sumner	Callahan	Dewey Square Southbound	Dewey Square Northbound*
No. of Lanes		2	2	3	3
Distance (Ft)		5680	5200	2360	2360
No-Build Alternative					
1982	1-hr Volume	2639	2847	4498	4196
	Speed	25	25	30	30
1990	1-hr Volume	2812	3737	6549	5624
	Speed	21	21	26	26
2010	1-hr Volume	3258	4070	6882	5550
	Speed	16	16	24	24
2 Lane Tunnel Concept					
1990	1-hr Volume	2146	2886	2960	3700
	Speed	35	35	38	38
2010	1-hr Volume	2479	3071	2812	4292
	Speed	34	34	38	38
Preferred Alternative					
1990	1-hr Volume	1591	2146	3256	3367
	Speed	35	35	38	38
	1-hr Volume	1998	2479	3404	3404
	Speed	34	34	38	38

*For the Preferred Alternative and 2 Lane Tunnel Concept, the Fort Point Channel Split Alignment, both of the Dewey Square Tunnels will be used for southbound traffic.

TABLE 51

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by VO at South Bay				
2 Lane Tunnel Concept				
A-0	1	300	925	962
A-0	1	300	296	370
A-0	1	700	1258	1295
A-0	1	400	652	963
A-0-SBD	2	300	1910	2258
A-0-NBD	1	700	592	740
A-0	1	500	222	222
A-0	1	300	777	925
A-0	1	200	1036	1147
A-0-NBD	5	700	4889	5291
A-0	1	500	510	600
J-0	5	1575	4921	5143
J-0-NBD	3	300	3885	3996
J-0	1	500	1036	1147
B-0-SBD	2	300	1910	2258
B-0	1	100	592	740
B-0-NBD	2	400	999	1295
B-0	5	300	4884	5291
B-0	1	400	510	600
Preferred Alternative				
A-0-NB	4	300	3441	3737
B-0	2	1000	1480	1739
A-0	1	600	370	296
B-0	2	400	1110	1443
B-0-NB	3	900	2331	2331
A-0	1	400	1554	1628
A-0	1	200	296	333
A-0	1	200	666	814
B-0	1	1200	666	814
B-0-NB	3	300	2146	2553

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by VO at South Bay				
Preferred Alternative (Cont'd)				
J-0-SB	2	1000	2331	2775
J-0	1	400	740	888
J-0	2	400	1591	1887
A-0	1	300	740	888
A-0	1	400	1258	1406
A-0	1	400	333	481
J-0-SB	4	1575	4144	4292
J-0-SB	1	800	1850	1961
Tunnel Segments Served by Vent V1 at Northern Ave				
2 Lane Tunnel Concept				
J-1-NBD	5	1575	4921	5143
E-1-NBD	5	540	4921	5143
E-1-SBD	5	500	5994	6179
Preferred Alternative				
J-1-NB	4	1575	4144	4292
J-1	1	1400	703	629
J-1-SB	4	200	5057	5069
E-1-SB	4	350	5057	5069
E-1	1	200	703	629
E-1-NB	4	400	4144	4292
Tunnel Segments Served by Vent V3 at Harbor Towers				
2 Lane Tunnel Concept				
E-3	1	400	2183	1961
E-3-NBD	5	360	4921	5143
E-3-NBD	5	100	7104	7104
E-3-NBD	5	500	5994	6179
F-3-NBD	5	850	7104	7104
F-3-SBD	5	850	5994	6179

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by Vent V3 at Harbor Towers (Cont'd.)				
Preferred Alternative				
E-3-NB	4	400	4144	4292
E-3	2	300	2442	2109
E-3-SB	4	350	5057	5069
E-3	1	900	900	962
F-3-NB	6	1200	6623	6475
F-3-SB	5	1800	5957	6031
Tunnel Segments Served by Vent V4 at Callahan Tunnel				
2 Lane Tunnel Concept				
F-4-NBD	5	850	4477	4218
F-4	1	900	2405	2442
F-4-SBD	5	600	3589	3700
G-4-NBD	5	1500	4477	4218
G-4-SBD	5	1600	3589	3700
Preferred Alternative				
F-4-NB	4	1000	4773	4699
F-4	1	700	1813	1887
F-4-SB	4	300	4144	4255
G-4-NB	5	900	4773	4699
G-4	1	1200	1036	1258
G-4-SB	4	900	4144	4225
Tunnel Segments Served by Vent V5 at Causeway Street				
2 Lane Tunnel Concept				
G-5	1	200	555	629
G-5	2	250	2146	2479
G-5	1	800	814	962
G-5-NBD	5	700	5254	5180
G-5	1	200	1332	1369

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by Vent V5 at Causeway Street (Cont'd.)				
2 Lane Tunnel Concept (Cont'd)				
G-5	2	400	2886	3071
G-5	1	1500	1554	1702
G-5-SBD	5	800	4477	4699
H-5-SBD	2	1000	4477	4699
H-5-NBD	2	2800	5254	5180
Preferred Alternative				
G-5	1	800	1036	1258
G-5-NB	5	1100	5709	5957
G-5-SB	5	1100	5180	5515
H-5	1	1000	1702	1998
H-5	2	1000	2109	2257
H-5	2	1800	2109	2257
Tunnel Segments Served by Vent V7 at A and Summer Streets				
2 Lane Tunnel Concept				
B-7-NBD	2	1320	1591	2035
B-7	1	700	407	700
B-7-SBD	2	1320	1910	1320
B-7	1	500	1041	500
Preferred Alternative				
B-7-NB	3	500	2146	2553
B-7-NBD	2	500	1702	2092
B-7	1	500	143	185
B-7	1	900	296	259
B-7	1	600	444	444
B-7-SB	2	600	1850	2333
B-7-SB	3	500	2331	2775

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by V8 at Viaduct and Summer Streets				
2 Lane Tunnel Concept				
B-8-NBD	2	1400	1258	1739
B-8	1	550	74	148
B-8-SBD	2	1400	1054	1443
B-8	1	700	185	298
Preferred Alternative				
B-8-NB	2	700	1702	2092
B-8-NB	2	700	2146	2516
B-8	1	550	444	444
B-8-SB	2	800	1850	2333
B-8-SB	2	600	1409	1776
B-8	1	800	441	557
B-8	1	1300	339	370
Tunnel Segments Served by V9 at Naval Base				
2 Lane Tunnel Concept				
B-9-NBD	1	750	1258	1739
B-9-SBD	1	750	1054	1443
C-9-NBD	1	1900	1258	1739
C-9-SBD	1	1900	1054	1443
Preferred Alternative				
B-9-SBD	2	750	1702	2146
B-9-NBD	2	750	2146	2516
C-9-SBD	2	1900	1702	1702
C-9-NB	2	1900	2146	2546
Tunnel Segments Served by V10 at Bird Island Flats				
2 Lane Tunnel Concept				
C-10-NBD	1	1900	1258	1739
C-10-SBD	1	1900	1054	1443
C-10-NBD	1	3000	1258	1739
D-10-SBD	1	3000	1054	1443

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by V10 at Bird Island Flats (Cont'd.)				
Preferred Alternative				
C-10-NB	2	1900	2146	2516
C-10-SB	2	1900	1702	2146
D-10	1	1500	322	414
D-10	1	500	714	918
D-10	1	1000	1036	1332
D-10-NB	2	2400	1026	1184
D-10-NB	2	3200	2146	2516
D-10	1	1600	999	1157
D-10-SB	2	400	551	814
D-10-SB	2	900	1550	1971
D-10	1	700	152	172
D-10-SB	2	3200	1702	2146

TABLE 52

EXHAUST VENTS EMISSION CHARACTERISTICS

	Volumetric Rate ($\times 10^3$ m^3/sec)	Exhaust Area (m^2)	Exhaust Velocity (m/sec)	1990 q_{CO} (g/sec)	1990 q_{NOX} (g/sec)	2010 q_{CO} (g/sec)	2010 q_{NOX} (g/sec)
2 Lane Tunnel Concept							
V0	0.98	96.2	10.2	30.41	2.60	27.63	2.33
V1	0.62	185.0	7.3	21.62	1.85	18.85	1.59
V3	0.65	62.0	10.4	25.99	2.47	19.83	2.12
V4	1.12	101.7	11.0	30.59	2.90	22.65	2.42
V5	0.90	88.7	10.2	46.81	4.44	35.97	3.84
V7	0.31	62.2	4.9	8.75	0.75	8.82	0.74
V8	0.32	44.6	7.3	5.49	0.47	6.40	0.54
V9	0.25	53.9	4.6	9.88	0.84	11.38	0.96
V10	0.46	138.0	4.7	18.27	1.56	19.57	1.80
S1	0.77	97.6	4.0	11.97	1.02	10.76	0.99
S2	0.77	97.6	4.0	7.69	0.66	6.91	0.64
C1	0.86	97.6	4.4	11.23	0.96	9.30	0.86
C2	0.86	97.6	4.4	12.97	1.11	10.74	0.99
DSSB1	0.56	58.0	4.8	5.69	0.54	4.07	0.43
DSSB2	0.56	58.0	4.8	4.69	0.45	3.36	0.36
DSNB1	0.71	58.0	6.1	5.94	0.56	5.19	0.55
DSNB2	0.71	58.0	6.1	7.03	0.67	6.14	0.66
Preferred Alternative							
V0	1.02	96.2	10.2	28.13	2.80	24.70	2.55
V1	0.55	185.0	10.2	17.30	1.72	14.06	1.45
V3	0.98	62.2	10.2	35.14	3.33	26.41	2.82
V4	0.72	101.7	10.2	24.60	2.33	18.83	2.01
V5	0.87	88.7	10.2	30.34	2.88	24.54	2.62
V7	0.34	62.2	10.2	6.87	0.69	6.53	0.68
V8	0.39	44.6	6.8	8.66	0.86	8.40	0.87
V9	0.50	53.9	10.2	14.59	1.45	13.26	1.37
V10	1.56	138.0	10.2	43.99	3.76	41.55	3.83
S1	0.77	97.6	4.0	14.57	1.25	14.25	1.31
S2	0.77	97.6	4.0	14.57	1.25	14.25	1.31
C1	0.86	97.6	4.4	17.99	1.54	16.18	1.49
C2	0.86	97.6	4.4	17.99	1.54	16.18	1.49
DSSB1	0.56	58.0	4.8	11.42	1.08	8.99	0.96
DSSB2	0.56	58.0	4.8	11.42	1.08	8.99	0.96
DSNB1	0.71	58.0	6.1	11.81	1.12	8.99	0.96
DSNB2	0.71	58.0	6.1	11.81	1.12	8.99	0.96

TABLE 53

SOURCE INPUT DATA FOR ISC MODEL FOR THE TWO-LANE TUNNEL CONCEPT IN 1990

Vent ID	NO_x Emission Rate (g/sec)	Stack Height (m)	Source Temperature (°K)	Exit Velocity (m/sec)	Diameter (m)
V0	2.60	30.5	299	10.2	11.1
V1	1.85	30.5	299	7.3	10.4
V3	2.47	30.5	299	10.4	8.9
V4	2.90	30.5	299	11.0	11.4
V5	4.44	30.5	299	10.2	10.6
V7	0.75	30.5	299	4.9	8.9
V8	0.47	15.2	299	7.3	7.5
V9	0.84	22.9	299	4.6	8.3
V10	1.56	30.5	299	4.7	11.2
S1	1.02	35.1	299	4.0	11.2
S2	0.66	35.1	299	4.0	11.2
C1	0.96	35.1	299	4.4	11.2
C2	1.11	35.1	299	4.4	11.2
DSSB1	0.54	30.5	299	4.8	8.6
DSSB2	0.45	30.5	299	4.8	8.6
DSNB1	0.56	30.5	299	6.1	8.6
DSNB2	0.67	30.5	299	6.1	8.6

APPENDIX 2:
NOISE AND VIBRATION

TABLE OF CONTENTS

		Page
2.1	Noise	1
2.2	Vibration	2

LIST OF TABLES

Table No.	Title	Page
1	Prototype Construction Noise Estimates at Nearby Sensitive Receptors	8
2	Summary of Construction Noise Impact, Relative to Existing Noise Levels	10
3	Traffic Data Used for Noise Calculations: Two-Lane Tunnel Concept	12
4	Identification of Existing Activities, Developed Lands, and Undeveloped Lands for Which Development is Planned, Designed, and Programmed, Which May Be Affected by Noise from the Highway	16
5	Traffic Noise Summary Comparison of Alternatives, Without Noise Barriers, Year 2010	18
6	Summary of "Severe" Noise Impact for the Two-Lane Tunnel Concept	20
7	Project Vibration Criteria	21
8	Estimated Vibration Impact Distances	22
9	Approximate Number of Buildings Potentially Affected by Vibration from Construction of the Two-Lane Tunnel Concept	23

2.1 NOISE

This section provides background information on the noise analysis for the Two-Lane Tunnel Concept of the Third Harbor Tunnel Project. The reader is referred to Appendix 6 of the DEIS/DEIR and its Supplement for background information on noise fundamentals, descriptors, measurements, prediction methods, and criteria.

Estimation of Project Noise Levels

Construction Noise

Prototype noise levels have been computed for anticipated project construction activities for the No-Build Alternative and Two-Lane Tunnel Concept. The method used to perform these calculations is documented in Sec. I.4.1 of DEIS/DEIR Appendix 6 (pages 13-21).

A range of 88-93 dBA L_{eq} at 50 feet, based on a prototypical construction scenario, was used along with point source distance adjustments to compute noise levels at typical nearby sensitive receptors. Table 1 contains the results of these calculations compared with existing noise levels.

The noise increases listed in Table 1 can be converted to subjective terms using the Project Criteria for Increase in Noise Level:

0-5 dB increase:	No impact
5-10 dB increase:	Minor impact
10-15 dB increase:	Moderate impact
Greater than 15dB increase:	Substantial impact

Comparative results for the No-Build Alternative and Two-Lane Tunnel Concept appear in Table 2. In terms of construction noise impact, both of these alternatives will have "substantial" impact on the Stillman Place residences in the North End, and, in addition, the Two-Lane Tunnel Concept will have "substantial" impact on the Spaulding Rehabilitation Hospital, the proposed Arts Building in South Boston, and the Boston Tea Party Museum.

The prototype computations upon which this impact analysis is based hinge upon nationwide average construction scenarios. The actual construction noise will depend strongly upon equipment types, usage factors, equipment placement, operating conditions, and construction schedules for this very complex project. Once this information is developed further, during detailed design, noise computations can be made project-specific. Only then can detailed noise mitigation be assessed and incorporated.

Mitigation measures that can often reduce noise impact from construction operations include:

- Limiting noisy construction activities to daytime hours near residential areas.
- Ensuring that all diesel-powered equipment at the construction site has effective mufflers. Frequently, faulty or ineffective mufflers are a major source of construction noise. The prototype calculations assume that all equipment is properly muffled.
- Erecting temporary noise barriers between sensitive receptors and particularly noisy or close construction operations.

For impact pile driving, a major source of noise for the Two-Lane Tunnel Concept, potential noise control options include the use of shrouds and exhaust mufflers, or use of alternative methods (e.g., caisson drilling, vibratory pile driving, or slurry wall construction).

Traffic Noise

Traffic noise from the Third Harbor Tunnel and its associated roadways was calculated in accordance with current FHWA procedures. Section

I.4.2 of Appendix 6 of the DEIS/DEIR describes these procedures and all modifications to them used for this project.

Table 3 lists all of the traffic data used for calculation of noise for the Two-Lane Tunnel Concept at each site in the study area. For the vast majority of links, the design-year AM Peak traffic hour was found to be louder than the design-year PM Peak traffic hour. Therefore, for the Two-Lane Tunnel Concept, only the AM Peak traffic noise condition was evaluated. The Level-of-Service C automobile noise was evaluated and included as described in Appendix 6 of the DEIS/DEIR.

Calculation of indoor traffic noise levels was accomplished, where required, by reducing the predicted exterior noise levels by the expected outdoor-to-indoor noise reduction. For site 2 (closed windows), this noise reduction was taken to be 25 decibels. For sites 8, 9, 12, 19, 20, and 22A (open windows), this noise reduction was taken to be 10 decibels.

Ventilation Building Noise

Noise from the proposed tunnel ventilation buildings would result primarily from operation of the fans used for tunnel air supply and exhaust. The amount of noise generated by such fans would depend on the number of fans, the fan types, sizes, and air volume flow rates, the pressure drops across the fans, and the operating efficiencies of the fans. The resulting level of fan noise at any given noise-sensitive receptor in the community would further depend on the specific design configuration of the ventilation building duct system and on the distance and orientation of the vent building air intake and exhaust openings relative to the given receptor position.

As indicated by the above discussion, noise from the proposed ventilation buildings would depend strongly on design details, many of which have not yet been determined. Therefore, accurate estimates of ventilation building noise cannot be made at this time. However, during project design, a detailed acoustical analysis will be performed in order to estimate ventilation building noise at sensitive community locations. If such estimates exceed the applicable state and city guidelines or regulations, noise control treatments (e.g., special fan designs, lined ducts, mufflers, etc.) will be incorporated into the design in order to achieve acceptable noise levels. Thus, by using proper noise control design practice, it is anticipated that noise impact due to the proposed tunnel ventilation buildings will be avoided.

Traffic Noise Levels: Assessment and Possible Noise Abatement

Noise levels were calculated at the 18 noise-sensitive receptor sites discussed in the FEIS/FEIR. Table 4 lists these sites and further generalizes them to include all (1) existing activities, (2) developed lands, and (3) undeveloped lands for which development is planned, designed, and programmed -- where such activities and lands are noise-sensitive and where they may be affected by noise from project roadways. The basis for these generalizations is that the selected analysis sites represent geometrical relationships to project roads that are similar to those for all noise-sensitive receptors that may be significantly affected by noise from these roads. Table 4 also indicates the approximate number of residents represented by the receptor sites.

Table 5 is a noise summary for the No-Build and the Two-Lane Tunnel Concept. It combines the calculated noise from project roadways (these include both limited-access roadways and local streets -- but only those involved in project construction, either newly constructed or widened) with estimated noise from other sources added into the total noise

level at each receiver. This total noise level allows meaningful intercomparison among alternatives. Note that the No-Build Alternative contains no project roadways, and therefore project noise for this case does not appear in the table.

The FHWA requires that the total roadway noise be compared to their Noise Abatement Criteria (NAC) and to existing noise levels, to assess project noise impact. If feasible and reasonable, noise abatement is required where this total noise exceeds either of these two criteria.

Table 5 lists the applicable FHWA Noise Abatement Criteria. The criterion for sites 2, 8, 9, 12, 19, 20, and 22A is the indoor criterion of the FHWA. These Category-E sites have no exterior land use exposed to the project. The criterion for all other sites is the FHWA outdoor criterion (Category B).

Table 6 follows directly from these tabulated noise levels and criteria. It lists where "severe" noise impacts occur -- for which sites, under which alternatives, and whether the impact is due to excess over the Noise Abatement Criterion or due to a significant (15-decibel) increase over existing noise. The word "severe" follows usage recommended by the FHWA. The FHWA states that when the Noise Abatement Criteria are exceeded, the noise level is so bad that substantial mitigation must be provided, when it is reasonable and feasible to do so.

Where impact occurs in Table 6, noise barriers have been examined and evaluated, using FHWA-approved barrier calculation procedures. Such noise barriers, which block the line-of-sight between receivers and traffic, and thereby reduce the traffic noise, are discussed in detail in Section 3.7.1 of this report. In summary, noise barriers are likely to be built to provide noise abatement at sites 1, 11, and 19.

2.2 VIBRATION

This section provides background information related to the vibration analysis for the Two-Lane Tunnel Concept of the Third Harbor Tunnel Project. The reader is referred to Appendix 6 of the DEIS/DEIR and its Supplement for background information on vibration fundamentals, descriptors, measurements, prediction methods, and criteria. For convenience, a summary of the project vibration criteria is provided in Table 7.

Vibration Assessment and Mitigation

The assessment of potential vibration effects from construction and operation of the Two-Lane Tunnel Concept is accomplished by comparing predicted project vibrations with the project vibration criteria (see Table 7) and with measured existing vibrations (where appropriate). The methodology for vibration predictions is described in Sec. II. 4 of DEIS/DEIR Appendix 6 (pages 97-109).

The comparison of predicted vibrations with the criteria results in a set of distances from project vibration sources within which different types of vibration effects would be expected to occur for various types of buildings or structures. The estimated vibration "impact distances" thereby determined for general use in this assessment are summarized in Table 8. The actual number of potentially affected buildings and structures is determined by performing an inventory of such structures within the appropriate "impact distances" using land use maps. Assessment and mitigation of potential vibration effects for the Two-Lane Tunnel Concept are described below.

Construction Period Effects

The major source of ground vibration during construction of the Two-Lane Tunnel Concept will be pile driving and slurry wall construction, with pile driving being the dominant

source. In the Central Area, intermittent pile driving will occur over a one to two year period for the support of relocated utilities. Soldier piles will also be driven over a period of approximately one year in each 1,000-ft segment of construction for site preparation, and some sheet piles will be driven for depressed ramps and tunnel crossings. The remainder of construction in the Central Area will primarily involve excavation and slurry wall construction for about one to 1-1/2 years in each section. In the North, South, and East Boston areas of the project, exposure to foundation or sheet pile driving vibration is expected to occur for periods of two to three months at nearby sensitive locations.

Maximum vibrations during construction along the existing Central Artery corridor are expected to be 3 to 20 times as great as the maximum vibrations measured at sites E through I (see Sec. 3.6.2 of the FEIS/FEIR). At site J (Spaulding Rehabilitation Hospital), maximum construction vibrations are not expected to exceed existing maximum vibrations from commuter rail operations, but would be continuous during pile driving near this location.

Potential effects of construction-related vibration include damage to structures, annoyance to people, and disruption of sensitive equipment operation. An assessment of the potential effects for the Two-Lane Tunnel Concept is provided in the following paragraphs. Where appropriate, mitigation measures for minimizing these effects are also discussed.

Damage Effects

A review of the planned construction indicates the potential for structural damage caused by vibration at the Hanover Street Post Office and Boston Police Academy during soldier pile driving at the Sumner Tunnel portal within six feet of these buildings. Such vibration could be mitigated by pre-augering holes (before the piles are driven) in order to increase the distance of the driven pile tip from the building foundations.

During slurry wall construction, the potential for structural damage exists for planned excavation within one foot of the Purity Cheese Company building in the North End and the MBTA Orange Line subway tunnel near North Washington Street. Methods for mitigating vibrations from slurry wall construction include the use of careful construction practices to avoid impacts between the slurry wall bucket and the adjacent structures.

For construction across the MBTA Red Line tunnel in Fort Point Channel near the Gillette Company, there is potential for vibration-induced structural damage during excavation around the subway tunnel. Such impact will be mitigated by strengthening of this tunnel prior to construction as discussed in the Supportive Engineering Report.

For construction across the MBTA Red Line tunnel in Fort Point Channel near Summer Street and across the Blue Line tunnel at State Street, vibration levels are not expected to exceed the criterion limit for structural damage (peak velocity of 1.9 in./sec.). However, pile driving at these locations is expected to result in subway tunnel ceiling vibrations that exceed existing vibrations due to train operations. Due to the sensitive nature of these tunnels, it is recommended that vibration mitigation techniques be investigated during project design. Such techniques include water jetting and pre-excavation for sheet pile driving and pre-augering and use of low-displacement piles for bearing pile driving.

In terms of architectural damage, analysis estimates indicate that the vibration criteria for this effect would be exceeded at approximately 26 residential buildings

in the North End, 26 office or commercial buildings, 14 industrial buidings, and at the Boston Garden and Children's Museum. Excessive vibration levels at these predominantly historic buildings would result from nearby pile driving operations. Potential mitigation techniques include those methods described above. In addition, the substitution of slurry wall construction for pile driving, where possible, could also be an effective vibration mitigation technique.

It is also expected that the 0.20 in./sec. vibration criterion for architectural damage will be exceeded at the Spaulding Rehabilitation Hospital, with a maximum estimated ground vibration velocity of 0.35 in./sec. during sheet pile driving for the Leverett Circle connector ramps. However, measurements have indicated a maximum existing ground vibration level of 0.47 in./sec. due to nearby commuter train traffic, and, therefore, architectural damage effects are not anticipated at this building.

Annoyance Effects

In terms of construction vibration annoyance effects, it is estimated that the criteria for residential buildings would be exceeded at approximately 40 three-story residential buildings in Charlestown, 52 residential buildings in the North End, Harbor Tower, the Dockside Condominiums, the Albany Street Apartments (South End), and at the proposed Arts Building in South Boston (259 A Street). In Charlestown, annoyance caused by pile driving vibration is expected to occur for about two to three months, with maximum vibration velocities inside the nearest residential buildings of about 0.04 in./sec., which could be characterized as "easily noticeable." In the North End, annoyance due to pile driving vibration is expected to occur intermittently over a one to two year period during utility relocation and for about one year during site preparation. Maximum vibration velocities inside the nearest residential buildings are expected to be on the order of 1.0 in./sec., which could be characterized as "very unpleasant." Note that building vibration in this area during slurry wall construction, occurring for about 1 to 1-1/2 years, is expected to be one-tenth as great as during pile driving, affecting about one-half as many people. At Harbor Towers, it is expected that residents on the four lowest floors of the building closest to the Central Artery would be annoyed by vibration during pile driving for nearby utility relocation. Building vibration velocities of 0.05 in./sec. or less are expected during this operation, which could be characterized as "easily noticeable." At the Dockside Condominiums, vibration annoyance is expected to occur for about two months during pile driving for the temporary Gillette water intake pipe supports. Maximum building vibration velocities experienced during this period would be on the order of 0.08 in./sec, which could be characterized as "strongly noticeable." At the Union Park/Albany Street Apartments, residents living within about 200 feet of Albany Street would likely be annoyed by vibration during pile driving for a nearby ramp. Pile driving operations are expected to occur near this location for at most two months, producing building peak velocities of 0.04 in./sec. or less; such vibration levels could be characterized as "easily noticeable." Finally, annoyance caused by pile driving vibration in South Boston is expected to occur for about two to three months in the vicinity of the proposed Arts Building at 259 A Street. Maximum vibration velocities inside the nearest residential buildings are expected to be about 0.2 in./sec., which could be characterized as "unpleasant."

In addition to the above residential buildings, annoyance effects are anticipated for about 41 office or commercial buildings, 29 industrial buildings, and 11 institutional or hotel buildings. The

latter group includes Bunker Hill Community College in Charlestown, the MDC Police Station at Leverett Circle, St. Mary's Church, the Hanover Street Post Office, Boston Police Academy, and Paul Revere House in the North End, Boston Garden, the Oliver Street Fire Staton plus the Long Wharf Marriott, Bostonian and Logan Airport Hilton hotels. Annoyance effects are also anticipated at the Spaulding Rehabilitation Hospital for about two months during sheet pile driving for the nearby Leverett Circle connector ramps. Maximum building vibrations during this period are expected to range between 0.02 and 0.2 in./sec., depending on location within the building. Such levels of vibration could be characterized as "easily noticeable" to "unpleasant."

Potential mitigation techniques for alleviating the above effects include water jetting and pre-excavation for sheet pile driving and pre-augering and the use of low-displacement-type piles for bearing pile driving. In addition, the substitution of slurry wall construction for sheet pile driving, where possible, could also be an effective vibration mitigation technique. Methods for mitigating vibration from slurry wall construction include the use of careful construction practices to minimize impacts between the slurry wall bucket and the ground or adjacent structures. The feasibility and effectiveness of the above mitigation techniques will depend on site-specific conditions and should be further evaluated during project design.

Effects on Sensitive Equipment

The effects of construction vibration on sensitive equipment operation are of particular concern at the Gillette Company facilities in South Boston. The results of the present evaluation indicate that building vibrations from tunnel construction are expected to be less than the maximum existng vibrations measured near sensitive equipment at Gillette. Higher levels of vibration would be expected, however, during pile driving for the supports of a temporary water intake pipe for Gillette, along the east side of Fort Point Channel. This activity would be closest to Building Z, inside which the highest existing vibrations were measured. As a result, vibrations caused by this activity would be expected to exceed maximum existing vibrations at only 2 out of 11 sensitive locations, with estimated peak velocities of 0.033 in./sec. at Gillette measurement position 10 and 0.045 in./sec. at position 11. It is anticipated that such vibration could be mitigated by the use of low-displacement piles and/or by coordinating pile driving operations with Gillette to avoid any interference with sensitive equipment operation.

Summary

A general summary of anticipated building vibration effects for construction of the Two-Lane Tunnel Concept is provided in Table 9. This table indicates the approximate number and types of buildings which are expected to be subject to vibration damage or annoyance effects. Assuming a population density of 84 people per acre in the North End, and an affected area of 25 acres, it is estimated that approximately 2,100 people in the North End would be disturbed by vibration during pile driving. During slurry wall construction, this number would be reduced by about one half. Assuming that elsewhere in the project area, an average of two people occupy each residential unit, it is estimated than an additional 500 residents would be annoyed by pile driving vibration. Therefore, it is estimated that approximately 2,600 people living in the project area would be annoyed by vibration during some portion of the construction period for the Two-Lane Tunnel Concept. It is expected that this number could be reduced by the use of the vibration mitigation techniques discussed above.

Long-Term Effects

No adverse long-term (i.e., traffic) vibration effects are anticipated after implementation of the Two-Lane Tunnel Concept. In fact, some long-term vibration benefits can be expected after depression of the elevated portion of the Central Artery. In particular, at locations near existing Central Artery columns where traffic vibrations are now perceptible, vibrations are expected to become imperceptible after the viaduct is removed.

As no long-term vibration impacts have been identified, no mitigating measures are required.

Table 1

PROTOTYPE CONSTRUCTION NOISE ESTIMATES AT NEARBY SENSITIVE RECEPTORS

Receptor	Measurement Site No.	Project Alternatives	Distance to Nearest Construction (Ft)	Construction Noise (dBA L_{eq})	Existing Noise (dBA L_{eq})	Noise Increase (dBA)
Edward Everett House	17	Two-Lane Option	275	73-78	69	4-9
Charles River Park Dam	18	No-Build and Two-Lane Option	250	74-79	69	5-10
Mass. Rehab. Hospital	None	Two-Lane Option	50	88-93	71*	17-22
Casa Maria Housing	20	No-Build & Two-Lane Option	175	77-82	71	6-11
Stillman Place Residence	19	No-Build & Two-Lane Option	50	88-93	72	16-21
Quincy Market	21	No-Build & Two-Lane Option	100	82-87	71	11-16
Waterfront Park	16	No-Build	225	75-80	69	6-11
		Two-Lane Option	125	80-85	69	11-16
Harbor Tower	(22A)	No-Build	250	74-79	69*	5-10
		Two-Lane Option	150	78-83	69*	9-14

*Estimated from nearby and/or similar situation measurements.

Table 1 (Cont'd.)

PROTOTYPE CONSTRUCTION NOISE ESTIMATES AT NEARBY SENSITIVE RECEPTORS

Receptor	Measurement Site No.	Project Alternatives	Distance to Nearest Construction (Ft)	Construction Noise (dBA L_{eq})	Existing Noise (dBA L_{eq})	Noise Increase (dBA)
Proposed Arts Bldg. (259 A. St., So. Boston)	None	Two-Lane Option	50	88-93	70*	18-23
Boston Tea Party Museum	4	Two-Lane Option	100	82-87	65	17-22
Dockside Condominiums	3	Two-Lane Option	750	64-69	73	0
Rotch Playground	1	Two-Lane Option	150	78-83	69	9-14
Albany Street Apartments	None	Two-Lane Option	400	70-75	66*	4-9
Maverick Street Residences (Jeffries Point)	12	Two-Lane Option	700	65-70	64	1-6
E. Boston Recreation Area	10,11	Two-Lane Option	500	68-73	66	2-7
Porzio Park	13	Two-Lane Option	850	63-68	69	0
Bremen Street Residences (North of Porter Street)	8,9	Two-Lane Option	2500	54-59	68-69	0

Estimated from nearby and/or similar situation measurements.

Table 2

SUMMARY OF CONSTRUCTION NOISE IMPACT, RELATIVE TO EXISTING NOISE LEVELS

Receptor	Measurement Site No.	Impact by Alternative	
		No-Build Alternative	Two-Lane Tunnel Option
Edward Everett House	17	None	Minor
Charles River Dam Park	18	Minor	Minor
Mass. Rehab. Hospital	None	None	Substantial
Casa Maria Housing	20	Minor	Minor
Stillman Place Residence	19	Substantial	Substantial
Quincy Market	21	Moderate	Moderate
Waterfront Park	16	Minor	Moderate
Harbor Tower	(22A)	Minor	Moderate
Proposed Arts Building (South Boston)	None	None	Substantial
Boston Tea Party Museum	4	None	Substantial
Dockside Condominiums	3	None	None
Rotch Playground	1	None	Moderate
Albany Street Apartments	None	None	Minor

Table 2 (Cont'd.)

SUMMARY OF CONSTRUCTION NOISE IMPACT, RELATIVE TO EXISTING NOISE LEVELS

Receptor	Measurement Site No.	Impact by Alternative	
		No-Build Alternative	Two-Lane Tunnel Option
Maverick Street Residences (Jeffries Point)	12	None	None
East Boston Recreation Area	10,11	None	None
Porzio Park	13	None	None
Bremen Street Residences (North of Porter Street)	8,9	None	None

TABLE 3

TRAFFIC DATA USED FOR NOISE CALCULATIONS: TWO-LANE TUNNEL OPTION

Measurement Site	Roadway Link	Volume (AM Pk.Hr.)	Total Vehicle Truck Percentage	Medium Truck Percentage	Heavy Auto Volume	Los 'C'^ Speed/ 'C' Speed
1	Albany St.	2,166	5.0	3.7		19
	Central Artery SB on-ramp from Albany St.	684	5.0	3.6	576	30/45
	Central Artery SB	4,636	4.9	3.4		46
	Central Artery NB	9,690	4.9	3.4	7200	19/50
	Central Artery NB off-ramp to W. Fourth St.					
	South of Underpass	2,242	5.0	3.7		30
	North of Underpass	3,268	5.0	3.7		19
	Randolph Rd. underpass	1,026	5.0	3.7		13
	West Fourth St. from Dorchester Ave. to Albany	418 (EB)	1.0	2.5		28
		551 (WB)	2.8	0.4		29
2	Broadway Bridge EB	1,748	6.2	3.0	1440	16/25
	Broadway Bridge WB	1,102	6.5	3.7	720	30/30
	West Fourth St. from Dorchester Ave. to Albany	418 (EB)	1.0	2.5		28
		551 (WB)	2.8	0.4	280	29/30
	Central Artery NB off-ramp to Mass Pike WB	2,394	4.9	3.4	2880	28/45
	Central Artery NB off-ramp to proposed tunnel	7,904	4.9	3.4	4320	32/50
	Service Road from West Fourth St. to Broadway Bridge	1,406	5.0	3.7		33
	Central Artery SB	4,636	4.9	3.4		46
	Albany St.	2,166	5.0	3.7		19

TABLE 3 (Cont'd.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
3,4	Central Artery SB with exit ramp	2,736	4.9	3.4		42
	Central Artery SB	2,888	4.9	3.4		43
	Atlantic Ave.	2,774	5.0	3.7		10
8-13	Porter St. on-ramp to proposed tunnel	76	2.6	2.4		35
	Porter St. off-ramp from proposed tunnel	70	1.9	3.0		35
	Porter St. between proposed tunnel on-ramp & off-ramp)	38 (EB) 76 (WB)	5.3 2.6	5.0 2.4		15 15
	Porter St. (between proposed tunnel on-ramp & Airport Cross Rd.)	285 (EB) 570 (WB)	1.8 2.0	2.4 2.5		15 15
	Airport Access Rd. and off-ramp from proposed tunnel	3,844	1.2	1.6		25
	Airport Egress Rd. and on-ramp to proposed tunnel	2,244	1.4	1.1		25
8,9	Bremen St. NB	152	6.9	2.9		25
	Bremen St. SB	380	3.0	1.2		25
15,16	Surface Artery NB (East India Row-Waterfront Park)	695	5.0	3.7		31

TABLE 3 (Cont'd.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	Surface Artery NB (Waterfront Park-Fulton St.)	733	5.0	3.7		23
	Surface Artery SB (Callahan Tunnel-Broad St.)	1,187	5.0	3.7		22
	Central Artery NB (Surface Artery off-ramp)	3,002	5.0	3.7	1440	6/25
	Atlantic Ave.	608	5.0	3.7		32
17,18	Charlestown Bridge NB	418	5.0	3.7		15
	Charlestown Bridge SB	2,128	5.0	3.7		22
	New Rutherford Ave. NB	2,852	5.0	3.7		29
	New Rutherford Ave. SB	684	5.0	3.7		30
	On-ramp Rt. 1 NB	1,254	5.0	3.6	778	20/45
	Rt. I-93 NB off-ramp	1,596	5.0	3.6		45
	Rt. I-93 NB on-ramp	1,064	5.0	3.6		27
	Rt. 1 SB off-ramp	1,254	4.9	3.4		20
	Rt. I-93 NB	4,446	4.9	3.4	4320	48/50
	Rt. I-93 NB Connector from Leverett Circle	950	5.0	3.6		28
	Rt. I-93 NB	5,434	4.9	3.4		40
	Rt. I-93 SB	7,866	4.9	3.4	5760	27/50
	Rt. I-93 SB	4,218	4.9	3.4		25
	Rt. I-93 SB off-ramp	3,648	5.0	3.6	2880	12/50
	Main St. (Charlestown)	152	5.0	3.7		25
	Harvard St. (Charlestown)	152	5.0	3.7		25

TABLE 3 (Cont'd.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
19,20	Surface Artery NB (Salem St.-N. Washington St.)	1,786	5.0	3.7	1440	20/25
	N. Washington St. EB	893	5.0	3.7		25
	Surface Artery SB (Causeway St.-North St.)	2,204	5.0	3.7	2016	25/25
	Stillman St.	76	2.0	0		20
	Surface Artery NB (North Washington St.-Causeway St.) (Site 19 only)	721	5.0	3.7		25
	North Washington St. WB (Site 19 only)	1,565	5.0	3.7		25
21	Surface Artery NB (East India Row-Waterfront Park)	695	5.0	3.7		31
	Surface Artery NB (Waterfront Park-Fulton St.)	733	5.0	3.7		23
	Surface Artery SB (Callahan Tunnel-Broad St.)	1,187	5.0	3.7		22
	Commercial St. (Clinton St.-Surface Artery SB)	76	5.0	3.7		25
22	Atlantic Ave. (Northern Ave.-East India Row)	1,900	5.0	3.7		20
	Surface Artery NB	1,900	5.0	3.7		30
	Surface Artery SB (State St.-Oliver St.)	266	5.0	3.7		25
	Central Artery SB	2,888	4.9	3.4		43
	Central Artery SB on-ramp	2,736	4.9	3.4		42

TABLE 4

IDENTIFICATION OF EXISTING ACTIVITIES, DEVELOPED LANDS, AND UNDEVELOPED LANDS FOR WHICH DEVELOPMENT IS PLANNED, DESIGNED, AND PROGRAMMED, WHICH MAY BE AFFECTED BY NOISE FROM THE HIGHWAY

	Site	Activity or Land Use Represented	Approximate No. of People Represented
1.	Rotch Playground	Rotch Playground, near half	-
2.	St. Peter and Paul Church	St. Peter and Paul Church	-
3.	Dockside Condominiums	Dockside Condominiums, Children's Museum and associated open space	80
4.	Boston Tea Party Museum	Boston Tea Party Museum	-
8.	Bremen St. residence, 1-1/2 blocks northeast of Porter St.	All Bremen St. residences directly opposite the Airport Access Rd.	200
9.	Bremen St. residence, 2-1/2 blocks northeast of Porter St.	All Bremen St. residences out of direct line with the Airport Access Rd.	140
10.	East Boston Recreation Area, northwest base-ball backstop	Northwest portions of the East Boston Recreation Area	-
11.	East Boston Recreation Area, southeast base-ball backstop	Southeast portions of the East Boston Recreation Area	-
12.	Maverick St. residence	All Maverick St. residences between Jeffries and Lamson Sts.	120
13.	Porzio Park	Porzio Park	-
15.	Waterfront Park, Boston	Waterfront Park, near Atlantic Ave.	-
16.	Waterfront Park, Boston	Major portion of Waterfront Park	-
17.	Edward Everett House, City Square, Charlestown	Residences near City Square with a direct view of project roads	200
18.	Charles River Dam Park	Charles River Dam Park	-

TABLE 4 (Cont'd.)

	Site	Activity or Land Use Represented	Approximate No. of People Represented
19.	Stillman Place Residence, North End	Lower floors of residences along Stillman Pl., Cooper St., and Washington St. south of Thatcher St., with facades toward the Central Artery	480
20.	Casa Maria Housing, North End	Upper floors of nearby multi-story dwellings within 1 block of and with facades toward the Central Artery but with some shielding by other nearby buildings	340
21.	Quincy Market Mall, Commercial St., North Market St.	East end of Quincy Market Mall	-
22A.	Harbor Tower Condominiums Boston	Harbor Tower closest to the Central Artery; condominiums with a view of the Central Artery	310

TABLE 5

TRAFFIC NOISE SUMMARY COMPARISON OF ALTERNATIVES, WITHOUT NOISE BARRIERS, YEAR 2010

Site No.*	Description	Daytime Hourly L_{eq} (dBA)**							FHWA Activity Category	FHWA Noise Abatement Criterion (dBA L_{eq})
			No-Build Alternative			Two-Lane Tunnel Option				
		Existing	P	N	TOT	P	N	TOT		
1	Rotch Playground	69	--	80	80	81	<65	81	B†	67
2	St. Peter and Paul Church ***	38	--	47	47	43	38	44	E††	52
3	Dockside Condominums	73	--	71	71	64	67	69	B	67
4	Boston Tea Party Museum	65	--	75	75	66	74	75	B	67
8	Bremen St. Residence***	59	--	65	65	41	63	63	E	52
9	Bremen St. Residence***	58	--	65	65	40	62	62	E	52
10	East Boston Rec. Area	65	--	69	69	54	68	68	B	67
11	East Boston Rec. Area	67	--	72	72	61	72	72	B	67
12	Maverick St. Residence***	54	--	54	54	45	53	54	E	52
13	Porzio Park	69	--	61	61	54	61	62	B	67
15	Waterfront Park, Edge	--	--	81	81	74	60	74	B	67
16	Waterfront Park, 90 ft from edge	69	--	78	78	71	59	71	B	67
17	Edward Everett House	69	--	78	78	76	68	77	B	67
18	Charles River Dam Park	69	--	79	79	77	65	77	B	67

TABLE 5 (Cont'd.)

Site No.*	Description	Daytime Hourly L_{eq} (dBA)**							FHWA Activity Category	FHWA Noise Abatement Criterion (dBA L_{eq})
			No-Build Alternative			Two-Lane Tunnel Option				
		Existing	P	N	TOT	P	N	TOT		
19	Stillman Place Residence***	62	--	70	70	64	<55	64	E	52
20	Casa Maria Housing***	61	--	70	70	61	<50	61	E	52
21	Quincy Market Mall	71	--	81	81	71	65	72	B	67
22A	Harbor Tower Condominiums***	59	--	69	69	65	<55	65	E	52

*See Fig. 3.14 of the FEIS/FEIR.

**P = Project contribution; N = Non-project contribution; TOT = Total.

***Estimated interior noise levels.

†Category B refers to sites with exterior land use, including picnic areas; recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, public meeting rooms, schools, churches, libraries and hospitals.

††Category E refers to sites with interior use only, including residences, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

TABLE 6

SUMMARY OF "SEVERE" NOISE IMPACT FOR THE TWO-LANE TUNNEL OPTION

Site No.	Description	Total Noise Margin Above FHWA Noise Abatement Criteria (dB)	Total Noise More Than 15 dB Above Existing Noise
1.	Rotch Playground	14	-
2.	St. Peter and Paul Church	-	-
3.	Dockside Condominiums	2	-
4.	Boston Tea Party Museum	8	-
8.	Bremen St. Residence	11	-
9.	Bremen St. Residence	10	-
10.	East Boston Recreation Area	1	-
11.	East Boston Recreation Area	5	-
12.	Maverick St. Residence	2	-
13.	Porzio Park	-	-
15.	Waterfront Park, Edge	7	-
16.	Waterfront Park, 90 ft from Edge	4	-
17.	Edward Everett House	10	-
18.	Charles River Dam Park	10	-
19.	Stillman Place Residence	12	-
20.	Casa Maria Housing	9	-
21.	Quincy Market Mall	5	-
22A.	Harbor Tower Condominiums	13	-

TABLE 7

PROJECT VIBRATION CRITERIA*

Type of Effect	Maximum Peak Vibration Velocity† (in./sec)
Damage Effects	
Structural damage	1.9
Architectural damage	
- Historical buildings	0.08
- Nonhistorical buildings	0.2
Annoyance Effects	
Hospital and critical areas	0.005
Residential/institutional/hotel	
- Construction period	0.01
- Long term	0.007
Office	0.02
Factory	0.04

*Maximum existing vibrations serve as supplementary criteria to the values listed in this table.

†Refers to ground vibration in the case of damage effects and building vibration in the case of annoyance effects.

TABLE 8

ESTIMATED VIBRATION IMPACT DISTANCES*

a. Damage Effects

Vibration Source	Structural Damage	Architectural Damage: Historic Buildings	Architectural Damage: Non-Historic Buildings
Construction Period			
Pile Driving	6	150	60
Slurry Wall Construction	1	18	8
Long-Term			
Elevated or Rough Roads	**	6	3
Smooth At-Grade Roads	**	2	1
Roadway Tunnels	**	**	**

b. Annoyance Effects

Vibration Source	Building Category: Hospital and Critical	Residential/Institutional/Hotel: Wooden Floors	Residential/Institutional/Hotel: Concrete Floors	Office	Factory
Construction Period					
Pile Driving	400	460	330	260	170
Slurry Wall Construction	160	230	80	40	20
Long-Term					
Elevated or Rough Roads	55	130	40	14	7
Smooth At-Grade Roads	13	30	10	3	2
Roadway Tunnels	**	**	**	**	**

*Table entries are distances from the source (in feet) within which vibration impact is generally expected to occur. Different distances apply in cases where impact is evaluated on the basis of a comparison of existing and project vibrations (see text).

**No impact at any distance.

TABLE 9

APPROXIMATE NUMBER OF BUILDINGS POTENTIALLY AFFECTED BY VIBRATION FROM CONSTRUCTION OF THE TWO-LANE TUNNEL OPTION

	Building Category				
Type of Effect	Hospital and Critical	Residential	Institutional and Hotel	Office and Commercial	Factory and Industrial
Structural Damage	0	0	2*	1**	0
Architectural Damage	0	26	2†	26	14
Annoyance	1††	96	11	41	29

*Boston Police Academy and Hanover Street Post Office (North End)

**Purity Cheese Company.

†Boston Garden and Children's Museum

††Massachusetts Rehabilitation Hospital.